Displaced Communities, Environmental Change and Sustainable Livelihoods in Uganda

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DOI:
10.20933/100001221

Publication date:
2021

Document Version
Publisher's PDF, also known as Version of record

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Final Report

November 2021

Makerere University

University of Dundee

Scottish Funding Council
Comhairle Maoineachaidh na h-Alba

GCRF

Contents

Acknowledgements

The research team would like to thank all who contributed to the successful management and delivery of the project. In particular we are grateful for the invaluable assistance of the local research assistants and enumerators; host and refugee communities at both study sites; government agencies and NGO informants in Bidibidi, Kyangwali and Kampala.

We thank OPM Department of Refugees for their collaboration and support, through the MoU and providing access to both sites, and all Advisory Board members for their exceptional input into the project. Finally, we thank the Scottish Funding Council and the Global Challenges Research Fund (GCRF) for funding the delivery of this project.

Ethical approval for the project was given by University of Dundee Research Ethics Committee, Makerere University School of Social Sciences Ethics Committee, and the Ugandan National Council for Science and Technology. Any errors in the report are the responsibility of the authors.

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Front cover Images: (L) Enhanced Sentinel-2 satellite image of Bugoma Forest Reserve, adjacent to Kyangwali settlement, Uganda, 2021. (Source: European Space Agency). (R) Women return to camp with firewood, Bidibidi settlement, Uganda. All images were taken or created by the Project Team.

Recommended citation: University of Dundee/Makerere University. (2021). *Displaced Communities, Environmental Change and Sustainable Livelihoods in Uganda, Final Report.* Dundee: University of Dundee. DOI: 10.20933/100001221.

EXECUTIVE SUMMARY

1. Introduction

Uganda is one of the four top refugee-hosting countries in the world and the largest in Africa, a product of the surrounding geopolitical context and Uganda's progressive refugee laws and policy. Refugees in Uganda are afforded freedom of movement, the right to work, the provision of social services, and are allocated land for residential and agricultural use in settlements. High dependence on natural resources to meet needs for shelter, food, fuel and income generation has caused environmental change and degradation in and around refugee settlements. Increasing demand for fuelwood and timber amongst growing populations puts strain on forest resources, threatening biodiversity and the provision of ecosystem services critical to livelihoods. Yet these dynamics differ depending on socio-cultural, political-economic and ecological factors specific to local settlement contexts. This report generates a nuanced view of environment–livelihood interactions, informing recommendations for protracted refugee contexts. The research aims to: 'Explore how displacement impacts on environmental change and the subsequent development of sustainable livelihoods' through the following objectives:

- Examine the nature and extent of environmental change in different settlements using satellite remote sensing and field-based observations.
- Understand the various ways in which refugees and host communities, living in or around new and long-term refugee settlements, interact with the environment and ecosystem services.
- Explore the variety of knowledges and values of refugee and host households for understanding how the environment is used.
- Offer recommendations for the management of increasing pressure on land resources within sustainable livelihood practices for development and policy programming.

2. Research Context

Following consultation, Kyangwali and Bidibidi settlements were chosen as research sites. Kyangwali

A group of younger participants hold up the results of their participatory mapping exercise in Bidibidi.

(Kikuube district) was established in 1960 and primarily hosts refugees from DRC. Bidibidi (Yumbe district) was established in 2016 after an influx of refugees from South Sudan, and is now the largest settlement in Uganda. Differing population dynamics, cultural contexts, natural resource availability, diversity of livelihood practices and environmental change dynamics facilitated comparison between sites.

3. Methodology

The research adopted a mixed methods approach, using social science and remote sensing methods to explore and quantify the interactions between livelihoods and environmental change. A host community and refugee village were social science data collection sites in two refugee settlements. A pilot survey influenced the design of semi-structured interviews with 116 refugee and host community members. Participatory mapping activities were carried out with 25 groups separated by age, gender and refugee status. 30 key informant interviews were held with stakeholders at local and inter/national levels, including government, agencies and NGOs. In response to Advisory Board feedback, a settlement-scale household survey was undertaken in both locations, generating data on household composition, land and farming, livelihoods and income, and environmental use and degradation.

The scale of habitat, land cover and landscape change over 40 years was determined through analysis of satellite remotely-sensed imagery. A combination of land cover classification methods and change in vegetation indices was used to derive maps and trends

Evidence of mature tree felling and charcoal burning, Bugoma Forest, Kyangwali.

in forest and land cover change in and around both settlements. To account for differences in ecological settings and land cover types, different classification approaches were adopted for each location.

4. Environmental Change

Between 2015 and 2021, Kyangwali's shrubland and dense vegetation saw a clear reduction in 'landscape greenness' and the extent of tree cover in Bugoma Forest adjacent to Kyangwali settlement decreased by 7.5%. Limited land for agricultural production contributes to these changes, refugee populations being settled in areas historically used by hosts for cultivation and grazing, whilst refugee plot sizes are decreasing. Despite access restrictions in Bugoma Forest, both refugees and hosts enter the area illegally to obtain fuelwood and timber. Additionally, charcoal production for household use and sale also contributes to tree decline. Landscape fragmentation and tree cover loss in Bidibidi has increased significantly between 2015 and 2021. Tree and shrub land cover has reduced by more than 50%, and the mean patch size of remaining tree covered areas has reduced to just 11% of the 2015 value. Residential areas and bare ground have increased, whilst cleared forest has yet to regenerate. Land affected by bush burning, as a coordinated activity between refugees and hosts, has almost doubled in area, impacting the semi-natural mosaic of land cover and causing dynamic land cover change year-on-year.

Tree loss is largely driven by demand for firewood mainly although refugees also cut trees for construction of their dwellings. Firewood access challenges mean that demand for charcoal is increasing. Both communities produce charcoal for household use, but the activity is also driven by demand from larger urban centres including Arua and Kampala. Livelihood activities such as stone quarrying and brickmaking (often seasonal responses to crop farming challenges) also contribute to the increase in bare areas and loss of tree cover in Bidibidi.

5. Creating Sustainable Livelihoods

Access to agricultural land and natural resources is a livelihood challenge. Forest encroachment is stimulated by poverty and a lack of non-natural resource-based livelihood strategies. There are marked differences in land ownership, with refugees at both sites having to borrow or rent land from hosts. This is more common in Bidibidi where conflicts over farmland access are frequent and refugees suffer crop losses caused by host community cattle. Refugees are heavily dependent on host community legitimisation for access to natural resources, perpetuating refugee vulnerability.

In Kyangwali, access restrictions to Bugoma Forest impact on livelihood options, and risks associated with seeking forest products include gender-based violence. Despite intercommunity tensions and conflicts with state actors in Kyangwali, refugees' close proximity to Bugoma Forest means they are relatively autonomous from neighbouring host communities.

Refugee response programmes geared toward environmental protection have included environmental sensitisation and education, something which host

Sweeping brooms for sale, Bidibidi.

Maize garden, Kyangwali.

communities argue is needed to reverse current degradation trends. Communities understand deforestation as a critical issue, referring to the value of trees in terms of their direct benefits (e.g. fuelwood) and role in climate regulation, although broader biodiversity values are often overlooked. Contrary to perceptions that refugees lack a long-term stake in local ecological wellbeing, this research shows that the majority of refugees in Bidibidi planted trees in the past year. However, refugees report a lack of space to plant trees, lack of maintenance, and monitoring of tree survival.

At the national level, funding shortfalls and large refugee/host populations mean environmental objectives are often omitted from refugee interventions; or re-prioritised when impacted by external shocks such as the COVID-19 pandemic. Policy delivery has also suffered from a lack of collaboration between sectors and resulted in programme duplication.

Local level corruption facilitates deforestation due to insecure land and natural resource rights, exacerbated by the erosion of traditional authority and power to combat environmentally harmful activities. Particularly in Bidibidi, the arrival of refugees has brought into focus the fragility of traditional governance structures, leading to land and natural resource disputes between communities. In Kyangwali, hosts claim customary land has been sold by local leaders in collaboration with government and refugee representatives. There is evidence from elsewhere in Uganda that Community Forests (CF) and Collaborative Forest Management (CFM) arrangements can improve conservation and livelihood outcomes for the rural poor, but while encouraged by government policies, these approaches have not been implemented at either site.

6. Conclusions

The report shows that environmental changes are partly driven by local population pressures and associated natural resource-based livelihoods, particularly household demand for fuelwood and timber. Yet the analysis indicates that inter/national political–economic factors also drive change. Efforts to combat environmental change around settlements has also been hampered by a lack of sectoral coordination and collaboration. The report therefore suggests the following recommendations.

7. Policy Recommendations

1. Settlement and land-use planning

- Recommendation 1.1. Government partners and development agencies work together to develop a plan to guide decisions on establishment of new settlements and location of new refugees, based upon potential natural resource availability and requirements, and environmental impact assessments.
- Recommendation 1.2. Strategic settlement and land-use plans should ensure provision for at least one acre of woodlot per 100 households to satisfy household demand for firewood and timber, as stipulated in the MWE sector response plan.

2. Cross-sectoral collaboration and coordination on environment and livelihoods

- Recommendation 2.1. Closer partnership and collaboration between government sectors and agencies is required in order to address interlinked socio-environmental challenges.
- Recommendation 2.2. Important stakeholders, coordinated through NEMA, should be included in policy processes related to environmental management in refugee settlements.
- Recommendation 2.3. Improved coordination amongst implementing partners (IPs) to avoid programme duplication and resource wastage.

3. Environmental and livelihood interventions

- Recommendation 3.1. Interventions should be directed towards supporting livelihood diversification in host and refugee communities through vocational skills and enterprise training aligned to NDP III and based on market assessment by MOGLSD.
- Recommendation 3.2. Environmental sensitisation and education programmes are required to reverse current trends, and local/national government awareness programmes about environmental stewardship and degradation should be implemented.
- Recommendation 3.3. Interventions should be site and context specific, and may even vary within a particular settlement depending on differing environment–livelihood interactions between zones/ villages.
- Recommendation 3.4. Broader political-economic drivers of degradation need to be addressed, including urban and international charcoal demand, and improvements made in provision and sensitisation around affordable alternative fuel technologies.

House constructed of unburnt bricks, Bidibidi.

Women walking with collected sticks, Bidibidi.

4. Land and natural resource use rights

- Recommendation 4.1. Stakeholders should work with host and refugee communities to formalise land and natural resource access and sharing arrangements and address locally-specific issues such as bush burning and crop damage by livestock.

5. Community participation in forest and natural resource management

- Recommendation 5.1. In accordance with Ugandan forest policy and legislation, NFA and forest user groups should work toward CFM arrangements to share forest rights, responsibilities and benefits, and support the sustainable management of forest resources.
- Recommendation 5.2. In accordance with Ugandan forest policy and legislation, work toward the declaration of community forests on customary land, creating designated community-level institutions responsible for the sustainable use and management of forest resources.

6. Sustainable resources and landscape restoration

- Recommendation 6.1. Woodlots should be consolidated and planted adjacent to Bugoma CFR and on customary land in both settlements to provide household firewood and timber, incorporating agroforestry approaches allowing refugees to grow short rotation crops amongst trees.
- Recommendation 6.2. Research should be commissioned into best practice for forest and landscape restoration in refugee hosting landscapes to maximise use of limited financial resources and incorporates refugee and host community views to ensure successful outcomes.

1. INTRODUCTION

1.1 Background and Research Context

Uganda is one of the top four refugee hosting countries in the World and the largest in Africa (UNHCR 2020), a product of the surrounding geopolitical context and Uganda's progressive refugee laws and policy (Figure 1). Protracted conflict in neighbouring Democratic Republic of the Congo (DRC) has resulted in Uganda accommodating over 431,060 DRC refugees to date (UNHCR 2021a). However, the largest proportion of Uganda's refugees are of South Sudanese origin. In the 1980s people sought refuge due to war between the Sudanese People's Liberation Army/Movement (SPLA/M) and the Khartoum government, but recently Uganda has hosted unprecedented numbers of refugees because of power struggles among South Sudan's elite factions (Mulumba and Olema 2009; IRRI 2018). As of March 2021, Uganda accommodates over 911,000 refugees from South Sudan, 61.5% of the refugee population (UNHCR 2021b).

1.1.1. Geopolitical context

The Refugees Act of 2006 and the Refugee Regulations of 2010 provide the legislative framework on refugee protection, rights and management in Uganda, reflecting regional and international conventions (GRU 2006, 2010). Refugees are afforded freedom of movement, the right to work, the provision of social services, and are allocated land for residential and agricultural use in settlements (Krause 2016; UNDP 2017). These rights and entitlements reflect Uganda's integration of a humanitarian approach with development objectives, intended to generate self-reliance and sustainable livelihoods amongst refugees and host communities. Situated in the context of UNHCR's broader Development Assistance for Refugees (DAR) programming, the Ugandan government began implementing a self-reliance strategy (SRS) in the late 1990s, to empower refugees to support themselves and to establish mechanisms for the integration of social services for refugees with those of nationals (Krause 2016). Developed as key elements of the country's Comprehensive Refugee Response Framework (CRRF), OPM and UNHCR have launched the Refugee and Host Population Empowerment Strategy (ReHoPE) and Refugee Response Plan (RRP) (UNHCR 2017a, 2017b; OPM and UNHCR 2020). These policies seek to bridge the gap between humanitarian and development programming by supporting the integration of refugees into national and district development planning. Uganda's latest National Development Plan (NDP III) includes refugees per se in national planning and statistics (OPM and UNHCR 2020), targeting funding for multi-sectoral programmes focused on strengthening local government and community institutions, improving social service delivery, expanding sustainable livelihoods training, and addressing environmental degradation (Oliver and Boyle 2019; FAO and World Bank 2019a).

Figure 1. Uganda and its geopolitical context. Source: United States Central Intelligence Agency, Wikimedia Commons.

1.1.2. Human–environment interactions

Refugees and host communities depend on natural resources to meet their needs for shelter, cooking, agricultural production and income generation. More than 95% of refugees and host community members rely on forest biomass to sustain their livelihoods, especially for firewood, timber and charcoal (FAO and UNHCR 2017). This has led to a range of environmental impacts including land degradation, woodland loss, competition for water and grazing land resources and restricted access to fuelwood for cooking (Ahimbisibwe 2015; FAO and World Bank 2019b). Tree cover in Uganda has decreased from 28% to 7% over the last 20 years and more than 1 million hectares of forest has

been lost in the past decade. A continuation of this unsustainable trend will negatively affect Uganda's air, water, soil and biodiversity, the availability of ecosystem services to support livelihoods and potentially further strain refugee–host relations.

While sheer numbers of additional people relying on local ecosystem services for their livelihoods can exacerbate environmental degradation, the specific livelihood activities and actions that lead to the unsustainable use of natural resources are not straightforward, and are likely linked to ecological, cultural and political settings of displaced communities, as well as interactions with already growing host communities. Understanding of these human–environment interactions is essential for developing recommendations that help guide the implementation of humanitarian and development policy in protracted refugee contexts (Moore et al. 2014; Ehrkamp 2017).

1.2 Research Aim and Objectives

This research project focuses on the interrelationship between refugees' and host communities' use of natural resources, environmental degradation and livelihood sustainability in rural settlement contexts. The overarching aim is to 'Explore how displacement impacts on environmental change and the subsequent development of sustainable livelihoods'.

Specifically, the project set out to:

- Examine the nature and extent of environmental change in different settlements using satellite remote sensing and field-based observations.
- Understand the various ways in which refugees and host communities, living in or around new and long-term refugee settlements, interact with the environment and ecosystem services.
- Explore the variety of knowledges and values of refugee and host households for understanding how the environment is used.
- Offer recommendations for the management of increasing pressure on land resources within sustainable livelihood practices for development and policy programming.

2. Research Context: Kyangwali and Bidibidi Refugee Settlements

Uganda currently hosts almost 1.5 million refugees, from 8 countries, across 12 districts, in 14 settlements and in Kampala (UNHCR 2021a). Two settlements – Kyangwali (hosting mainly DRC refugees) and Bidibidi (hosting mainly South Sudanese refugees) (Figure 2) – were selected after consultation between the project team, the Advisory Board and national government (Office of the Prime Minister). This choice enabled capture of the experiences and evidence of human–environment interactions in settlements with differing populations, host community settings, natural resources endowments and traditional livelihood practices.

Established in 1960, Kyangwali refugee settlement in Kikuube district in Western Uganda covers an area of 95 km^2. Bordered by Lake Albert to the west and Bugoma Central Forest Reserve (CFR) in the east, the settlement is close to the border with the DRC, where most refugees living in the settlement are from. The landscape is dominated by riverine, tropical high and medium altitude moist semi-deciduous forests, typically experiencing 63 days without rain in any one year and

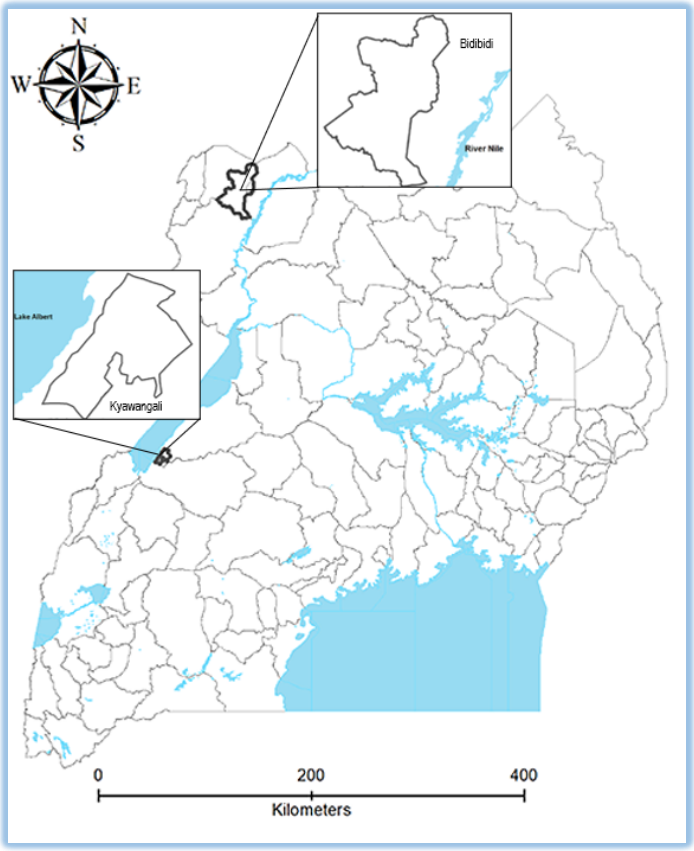
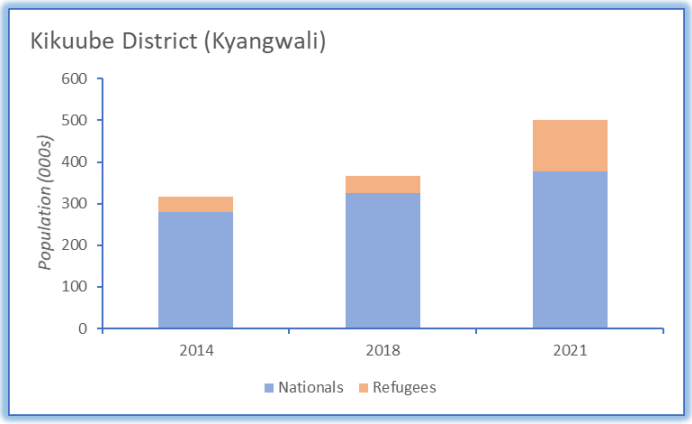


Figure 2. Location of Kyangwali and Bidibidi refugee settlements.



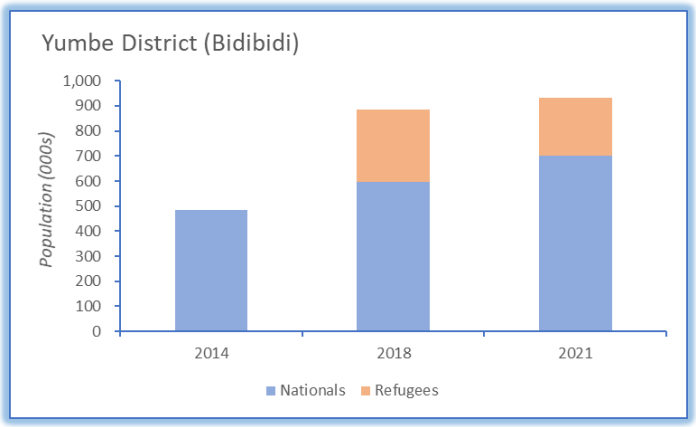


Figure 3. Population of Kikuube District in 2014*, 2018† and 2021† and Figure 4. Population of Yumbe District in 2014*, 2018† and 2021†. (*Data from National Population and Housing Census 2014; †projected national population UNHCR 2021).

average annual precipitation of 282 mm yr^{-1}. Due to ethnic tensions in DRC, Kyangwali's population increased by 236%; from 36,713 refugees in December 2017 (UNHCR 2018a) to 125,039 in February 2021 (UNHCR 2021b) (Figure 3). This represents a rise in the proportion of refugees in the population of the district as a whole from 12% in 2014 to 25% in 2021.

Bidibidi refugee settlement was established in September 2016 in Yumbe district, in the West Nile region of Uganda, after a sudden influx of refugees from South Sudan (Sieff 2016). Covering 250 km^2, Bidibidi is the largest settlement in Uganda hosting approximately 235,797 refugees (UNHCR 2021d) and is set within a landscape of medium-low density forest cover and savannah grassland. Average annual precipitation is 181.3 mm yr^{-1} and the typical number of days without rainfall in any one year is 142. The total population of the region has continued to grow (Figure 4), with refugees accounting for 32% of the population in 2018, dropping to 25% in 2021 (UNHCR 2021d).

Refugees in Bidibidi rely on in-kind food assistance whereas refugees in Kyangwali have moved to 100% cash assistance, apart from recent arrivals and child-headed households (OPM and UNHCR 2020). Refugees in Kyangwali take part in a greater range of income earning activities compared to refugees in Bidibidi (Figure 5). These results highlight the importance of selling crops and food rations in order to earn money and the prevalence of natural resource-based livelihoods. According to UNHCR (2021c), in Kyangwali 49.8% of adults (aged 18- 59 years) have an occupation, primarily related to farming, but also fishing, housekeeping and 'business professionals'. In contrast, in Bidibidi only 21.6% of adults have an occupation, primarily in farming (UNHCR 2021d).

As well as growing crops for food and to sell, households in both refugee hosting landscapes rear cattle and/or goats, to consume or sell. When asked where they graze their animals, most respondents from host communities (82%, n=489) responded that they do so within the village. However, cattle rearing is much more prevalent in Bidibidi than in Kyangwali (Figure 6) meaning that pressure on land for grazing (with attendant tensions resulting from bush burning and access for other livelihood activities) is more keenly felt.

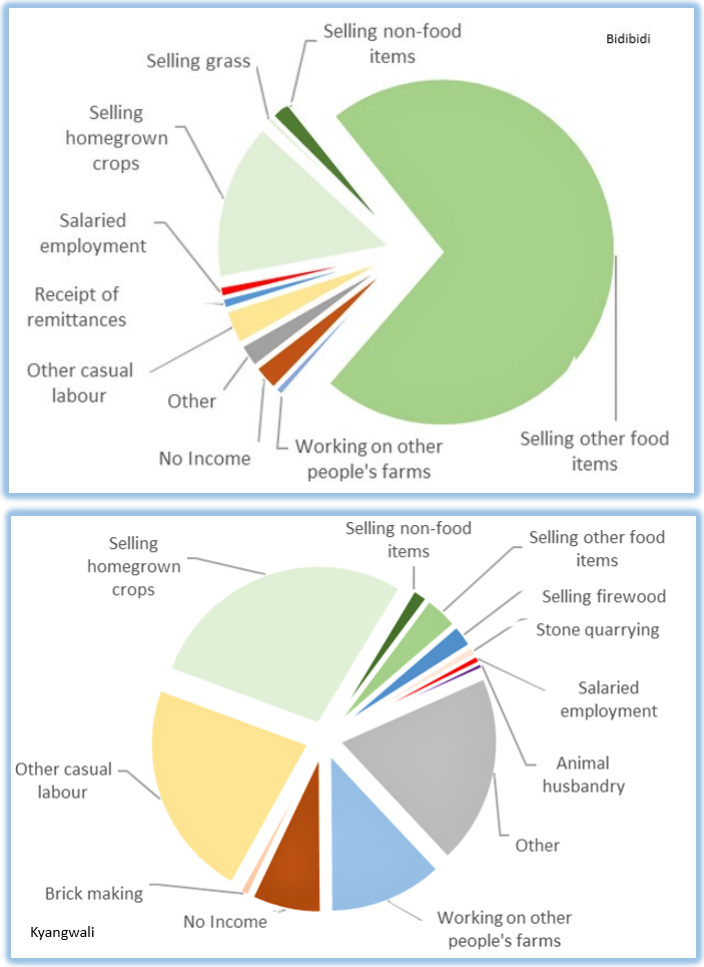


Figure 5. Household survey responses to the question "How does your household make money?" in Bidibidi and Kyangwali.

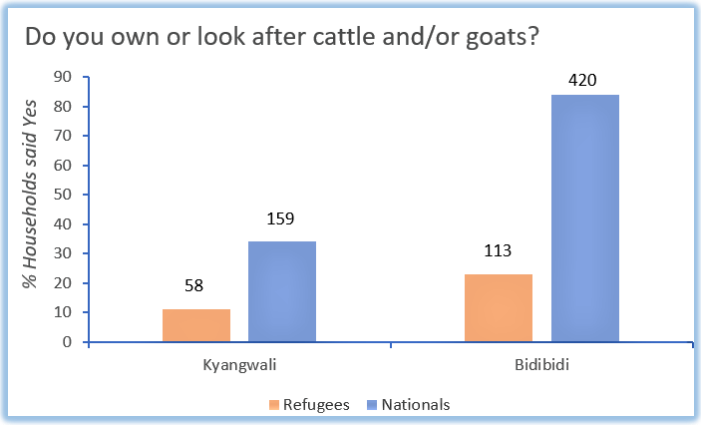


Figure 6. In Bidibidi, 84% of national and 23% of refugee households grazed livestock; 34% and 11% respectively in Kyangwali.

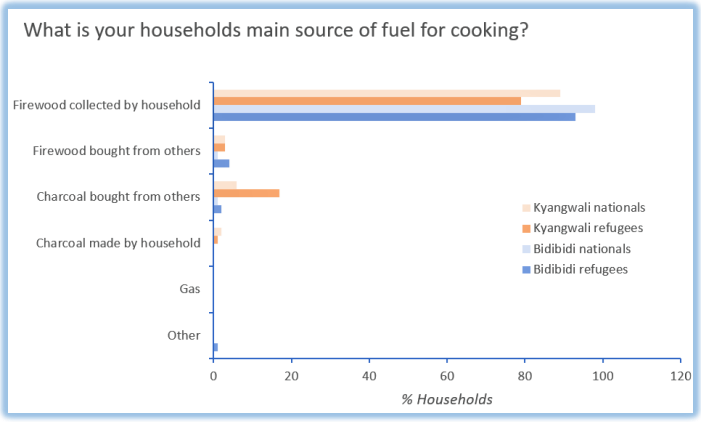


Figure 7. In Bidibidi, collected wood was the main source of cooking fuel for 98% of national and 93% of refugee households; 89% and 79% respectively in Kyangwali.

In both settlement areas, refugees and host communities rely on wood for fuel for cooking (Figure 7). In Bidibidi 98% (n=488) of host community households use firewood collected by the household as the main source of cooking, whilst 93% (n=455) of refugees collect and 4% (n=20) buy firewood to use as their main source of fuel. In Kyangwali, charcoal made by households (2% host community; 1% refugees) and bought (6% host community and 17% refugees) means that the population is slightly less reliant on firewood collection, but nonetheless this still remains the dominant source of fuel for cooking (89% and 79% for host community and refugee households respectively).

In Bidibidi, as well as wood collection, livelihood strategies include brickmaking and stone quarrying, where subsistence farming is less productive (Figure 5) (UNHCR 2017a). Here refugees have been settled on marginal, community-owned land close to local villages. Conversely, the land allocated to refugees in Kyangwali belongs to the government, borders the Bugoma CFR and is further from host community villages. These factors have a strong influence on livelihood practices and environmental change dynamics at both sites.

3. METHODOLOGY

The research adopted a mixed methods approach, using social science and remote sensing methods to demonstrate and quantify the interactions between livelihoods and environmental change. The methodology attends to the lived experiences of refugee and host communities, highlighting challenges and potential solutions to mitigate impacts on surrounding landscapes and promote sustainable livelihoods for local and displaced people.

3.1 Research Design

The methodology has two strands facilitating triangulation across data sources and types:

A social science approach employing techniques to explore how refugees and host populations use their knowledge, skills and ecosystem resources to create survival strategies and livelihoods. This strand used household surveys, in-depth interviews and participatory mapping with host and refugee households across all age groups (aged 10+) to reveal details of human–environment interactions.

A remote sensing approach employing satellite technology to determine the scale of habitat change and landscape fragmentation over the last 40 years. This strand used a combination of land cover classification methods (to derive forest and land cover change) and vegetation indices (to determine changes in forest status and degradation).

An Advisory Board, comprising members of government and non-governmental agencies, had a fundamental input into the planning, research design, implementation and interpretation of research findings through regular meetings with the project team.

3.2 Methods

The project engaged a depth-to-breadth strategy, beginning with in-depth work in communities and scaling up to include remote sensing and survey methods. This allowed a flexible iterative approach to the research where initial findings fed into subsequent investigation.

3.2.1 Preparatory fieldwork

In consultation with local stakeholders one host community and one refugee village were chosen as data collection sites in both settlements. In these villages a

household pilot survey of 140 refugee and host community households (70 households each in Bidibidi and Kyangwali) was undertaken in April and May 2019, with responses recorded using tablet-based ArcGIS Survey 123. This preparatory fieldwork generated baseline information including livelihood strategies and income-generating activities from household heads or other adult household members. Findings were analysed in statistical software, SPSS.

The survey was supplemented with field observations and transect walks, where researchers and community members took part in field observations together to observe community collection of forest products, and to examine environmental conditions while noting GPS points and taking photographs.

3.2.2 Qualitative community-based approaches

The pilot survey findings influenced the design of semi-structured interviews with 116 refugee and host community members (65 in Bidibidi; 51 in Kyangwali) within our case study villages. Community interviews took place in September to October 2019. Participants were aged from 10 years old, facilitating comparison between different demographics and locations, and allowing in-depth discussion of topics highlighted in the pilot survey.

A separate interview schedule was developed for 30 key informant interviews held between February and October 2020 with stakeholders at local and (inter) national levels, including employees from government, agencies, and NGOs provided important insights on issues including governance challenges and policy implementation.

Across both sites, participatory mapping activities were carried out in our case study villages between February and March 2020 with 25 groups of 5-8 people grouped by nationality, gender, and age range (10-15, 16-24, and those 25 years and over). During these sketch mapping exercises, participants drew maps of their villages and local areas, illustrating places where they engaged volved in refugee programming. These data with ecosystem services, such as where they collected firewood or burned charcoal. Co-creating maps served as a focal point for discussions with and between community members, allowing them to communicate local spatial knowledge and information regarding livelihood activities and environmental interactions.

Participants engage in a participatory mapping exercise in Bidibidi.

Maps were photographed and discussions recorded, translated, transcribed, and coded using NVivo, a qualitative data analysis software package. Community and Key Informant interviews were similarly recorded, translated, transcribed, and then coded in NVivo. Interviewee quotes are attributed pseudonyms to ensure participant anonymity. Settlement location and interviewee identity as refugee or host are also noted where necessary (e.g. Mary, refugee, Kyangwali).

Finally, in response to feedback from the Advisory Board, the project implemented a settlement-scale household survey, taking place in March and August 2021 in Bidibidi and Kyangwali respectively. The survey was conducted via a team of researchers using tablets, and contained 40 questions (including 94 sub-questions) across four sections, collecting data on households, land and farming, livelihoods and income, and environmental use and degradation. A sampling strategy (see Appendix) was designed to ensure the survey incorporated a representative sample of households; 989 in Bidibidi and 981 in Kyangwali, with similar numbers of Ugandan host community respondents (n=499; 50.5% in Bidibidi and n=465; 47% in Kyangwali). In Bidibidi, refugee households were from South Sudan (n=490; 49.5%); in Kyangwali, refugee households (n=516; 53%) were made up of refugees from DRC (n=471; 48%) and South Sudan (n=47; 5%). Gender balances reflected the make-up of the settlements, with proportionally more female respondents (n=634; 64% in Bidibidi and n=541; 55% in Kyangwali) than male respondents (n=355; 36% in Bidibidi and n=440; 45% in Kyangwali). Age ranges were

similar in the two sites, ranging from 17 in both to 98 in Bidibidi and 96 in Kyangwali, with a mean age of 38.8 and 38.6 respectively. Findings were analysed in statistical software, SPSS.

3.2.3 Satellite remote sensing

Remotely sensed satellite imagery was used to assess landscape change at both sites. To account for differences in ecological settings (seasonality, phenology) and land cover types, different approaches were adopted for Kyangwali and Bidibidi.

Kyangwali: Two separate methods were employed to detect changes in land cover and 'greenness' (a proxy for changing productivity and clearance of vegetation) within the settlement and extending to a 5km buffer around the settlement perimeter.

(i) Supervised image classification: To illustrate the landscape before the recent influx of refugees to Kyangwali in 2016 and 2019, two Sentinel-2 MSI images acquired in January 2015 and January 2021 during the dry season, were downloaded from European Space Agency' s Open Access Hub portal. Image classification of data obtained during this period provides the best chance of cloud free imagery and tends to achieve a higher accuracy when compared to those acquired at maximum greenness in the rainy season due to increased spectral separability of vegetation (Feng et al. 2015). The images were atmospherically corrected using Dark Object Subtraction (DOS) (Chavez, 1988) and classified using a supervised maximum likelihood classifier. Land cover classes and training sites were derived from high spatial resolution imagery from Google Earth and Planet® and transect mapping field visits, which also provided independent observations to test the accuracy of the resulting products. Post classification change detection was carried out using the methods described by Sallaba (2009).

(ii) Change in greenness: Changes in ecosystem productivity and greenness manifest as seasonal changes driven by rainfall and temperature patterns, gradual changes driven by inter-annual climate variability, and abrupt changes caused by disturbance such as deforestation, urbanisation, and land cover change. The Breaks for Additive Seasonal and Trend (BFAST) change detection algorithm integrates the iterative decomposition of time series into trend, season and noise components (Verbesselt et al. 2010).

Household Survey Sampling Strategy for Kyangwali and Bidibidi

A multi-stage sampling strategy was adopted; the first stage involved definition and selection of clusters. The study community was separated into two broad strata: refugee or host community, targeting around Refugee settlement zones and sub-counties that host the refugee settlement formed 'clusters'.

In Kyangwali the survey was carried out in each of the settlements' six zones, covering both 'new' and 'old' case refugees (those who have lived in Uganda for less than five years; and between five to twenty-five years). Host community households were selected from the villages surrounding the refugee settlement; from Katikara A and B, Lakeside villages and villages in the Bukanga areas.

In Bidibidi the survey was carried out in each of the settlement's five Zones. Host community households were selected from the five sub-counties that house Bidibidi refugee settlement in Yumbe District, namely Ariwa, Kochi, Kululu, Odravu and Romogi. For each Zone (refugee community), village (Kyangwali host community) and sub-county (Bidibidi host community) we worked with local leaders, Refugee Welfare Council Officers and Local Council chairpersons to identify villages. Five refugee villages were randomly selected from each Zone, each paired with the nearest host community village as a comparator. The second stage of sampling involved systematic sampling within each cluster (village) to select households. As up-to-date lists of all households within each cluster are not available, we used a sampling interval (rather than random sampling).

Ten research assistants (RAs), five each from refugee and host communities conducted the survey. Each RA worked in one Zone and one village every day. Data collection took five days. RAs were trained to select every fifth household starting from the village chairperson's homestead. Using this sampling interval ensured that RAs moved reasonable distances from one household to the next. Household heads were interviewed; and if unavailable another adult member of the same household was selected for interview. If no adult member was available, the household was replaced by the next fifth household.

Remote Sensing Glossary

ArcGIS: Geographic Information System by ESRI

BFAST: Breaks for Additive Seasonal and Trend

DOS: Dark Object Subtraction

ERDAS Imagine: software to process and extract information from satellite images

ESA: European Space Agency

ETM+: Enhanced Thematic Mapper Plus

Google Earth Engine: A platform for scientific analysis and visualization of geospatial datasets

Landsat 5 TM: a low Earth orbit satellite multispectral imaging sensor

Landsat OLI: Operational Land Imager, multispectral sensor, carried onboard Landsat 8

MSI: Multi-Spectral Instrument on-board the Sentinel-2 satellite

NDVI: Normalised Difference Vegetation Index

SAR: Synthetic Aperture Radar, as carried by Sentinel-1 satellite

Sentinel-1 and Sentinel-2: Polar-orbiting satellites operated as part of the ESA Copernicus Programme.

SEPAL: System for Earth Observation data access, Processing & Analysis for Land monitoring; freely available cloud computing platform for geospatial data processing.

Using the openforis tool, SEPAL, Normalised Difference Vegetation Index (NDVI) time series were retrieved using pre-processed Landsat 5 TM, Landsat 7 ETM+ and Landsat 8 OLI data for the study area from 2000 to 2019 using a 9-to-10-year time difference (2000 to 2010, 2005 to 2015 and 2010 to 2019). The time series were analysed by setting the historical and monitoring periods at five years. Positive change in NDVI represents vegetation regeneration/growth and negative change a loss of vegetative cover/greenness.

Bidibidi: The savannah and scrub landscape of northern Uganda contrasts with the agriculture and forest dominant landscape of Kyangwali. Semi-natural vegetation cover varies significantly with season and so the same methods used in Kyangwali were inappropriate for use in Bidibidi. Here, a combination of optical and Sentinel-1 SAR data were used to detect vegetation loss and changes in land cover within the settlement and a 5 km buffer surrounding it:

(i) Vegetation/tree cover loss: Sentinel-1 SAR images from 2015 and 2021 were used to determine vegetation loss. The SAR data were obtained from Google Earth Engine and had already been pre-processed using ESA's Sentinel-1 Toolbox. A ratio between the 2015 and 2021 images was calculated and a threshold applied based upon the resulting image statistics according to the method described by Podest et al. (2020). The resulting vegetation change mask depicts areas of vegetation change based on values greater than the standard deviation multiplied by 1.5 (Ibid.).

(ii) Land cover change maps were produced using a random forest classification using Sentinel-1 SAR and Landsat OLI data combined. Images were pre-processed and a random forest classifier trained according to the methods described by Symeonakis et al. (2018). Results were validated through a combination of analysis of high spatial resolution satellite data from PlanetLabs® and transect mapping field visits.

4. Environmental Change

This section explores the interrelationship between natural resource-based livelihood practices and land cover changes observed via remote sensing. It is clear the influx of refugees has added to existing pressures on natural resources at both sites, yet the research indicates an underlying complexity to understanding environmental change. Both host community and refugee livelihoods depend on natural resource access and use, meaning demand for food, water, (farm)land, fuel and building materials has increased alongside population numbers. As one Ministry of Water and Environment employee indicated, 'the livelihood of refugees is based on trees', such as the provision of fuelwood and timber, and is especially the case where alternative livelihoods and energy sources are lacking. Therefore, whilst natural resource-based livelihoods and population pressures clearly contribute to environmental change at both sites, there are important differences between settlements in terms of the specific complexities of human–environment interactions.

4.1 Environmental Change in Kyangwali

Unlike many other settlements, Kyangwali continues to receive refugees, despite temporary closures due to Covid-19. Between January and May 2021, the refugee

population increased by 4,548 due to births and new arrivals (UNHCR 2021e). At the same time, Ugandans have been attracted to settle near Kyangwali because of investment in local infrastructure that has accompanied the arrival of refugees [Adyeri, host, Kyangwali]. Pressure on natural resources thus continues to grow, and policy makers find it difficult to predict future population numbers given the volatility of the situation in neighbouring DRC. A staff member from the OPM office in Kyangwali stated:

'We are a receiving settlement […] receiving on a daily basis. That means we don't know how many we shall be tomorrow… If the 120,000 we have today are entering the forest to this extent, how about tomorrow when they grow maybe to 200 [thousand], what will happen?'

Change in land cover (Figures 8 and 9) indicates shrubland and dense vegetation classes have reduced in extent within the settlement between 2015 and 2021 (by 7.6% and 26.2% respectively), caused in part by the increasing population and authorities clearing land for settlement/infrastructure and agriculture (increases of 9.4% and 24.4% respectively). As the District Environment Officer noted, Kavule Forest and Bugoma Forest buffer areas such as Maratatu have been 'completely cleared of trees', where there is a clear reduction in 'greenness' of 33% over the monitoring period, particularly marked in 2016 with the arrival of large numbers of new refugees (Figure 10).

4.1.1 Farming pressures in Kyangwali

As the refugee population increases, land for agricultural production is becoming increasingly scarce for both refugees and hosts. A respondent from OPM conceded that plots allocated to refugees are reducing in size, with claims farmland originally given to longer-term refugees had since been withdrawn and reallocated as settlement plots for new arrivals (UNHCR 2018b). Hosts are struggling to acquire farmland, which they argue is a result of increasing refugee populations settled in areas that were historically used for cultivation. As one woman explained:

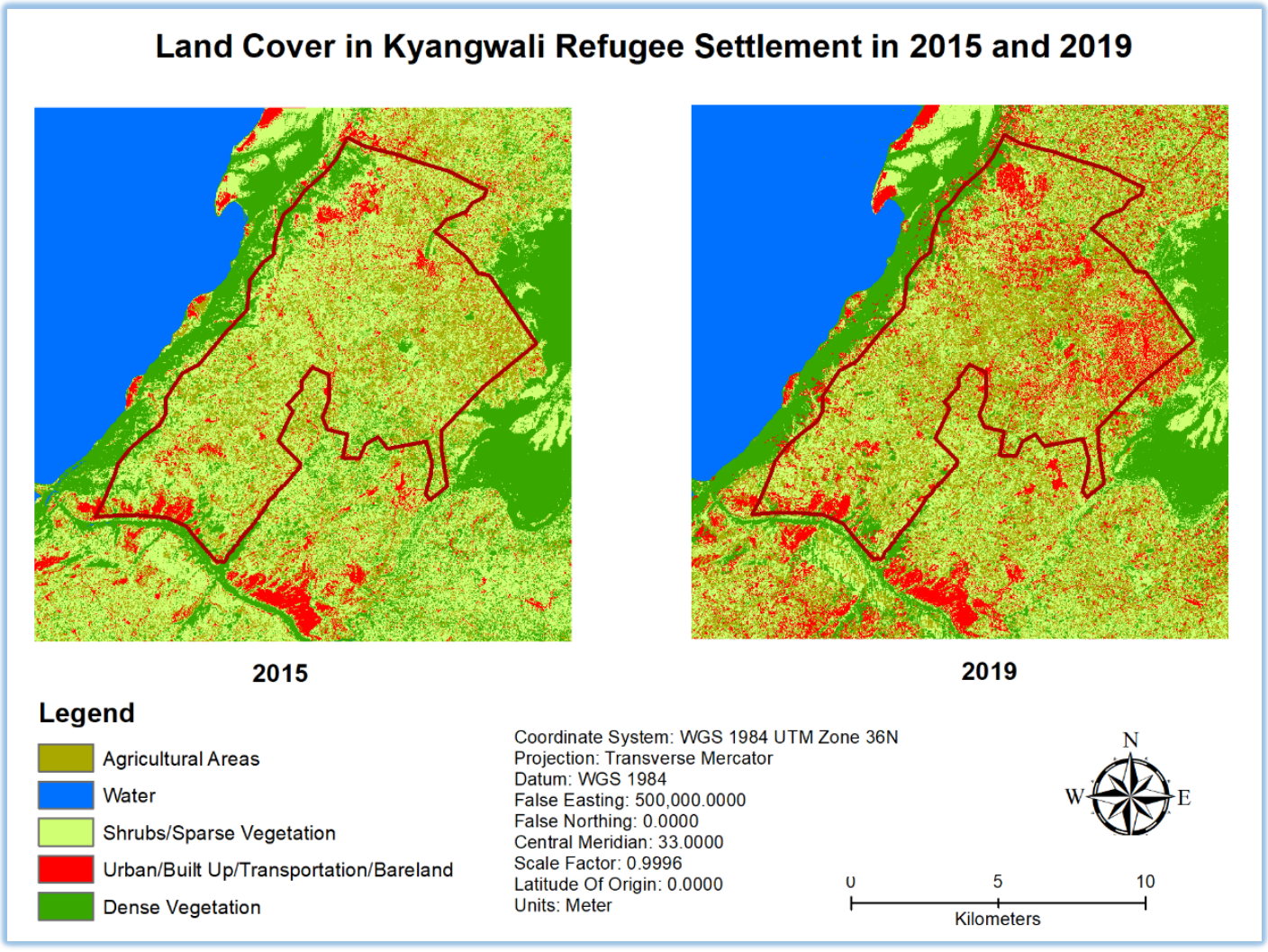


Figure 8. Land cover maps of Kyangwali and surrounding area, derived from Sentinel-2 images acquired in 2015 and 2021.

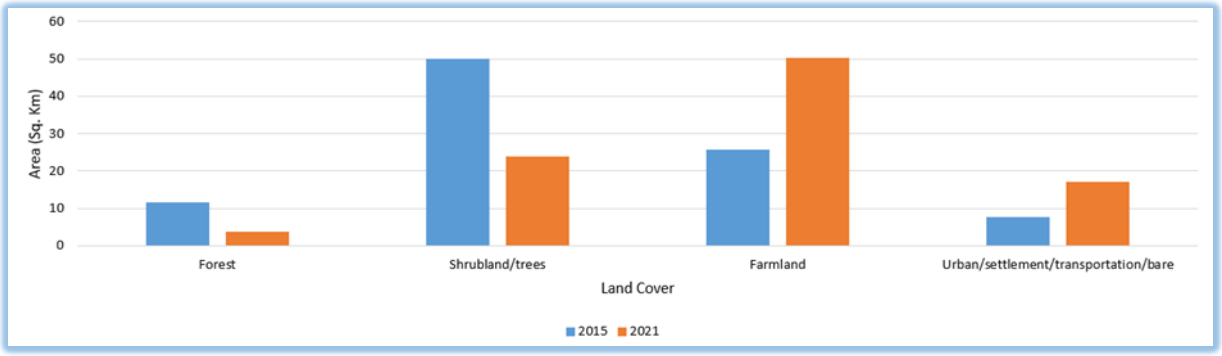


Figure 9. Land cover change (km^2) within Kyangwali settlement from 2015 to 2021.

'When I was a young child someone would go and identify unoccupied land, clear it and demarcate off what he wanted, […] but that is not possible anymore' [Akiki, host]

Others complained of being unable to rent farmland to refugees, as they had previously, because of land scarcity caused by 'too many refugees' [Adyeri, host], as well as resource-related business people from outside of the area buying plots of land and settling permanently [Veria, host].

In response to these land pressures, residents undertake farming practices that play a role in vegetation change on different temporal scales. Host community households with livestock are finding it increasingly difficult to access suitable grazing land, and respondents explained that 'during the dry season there is usually no pasture to feed the cows' [Morris, host]. As a result, for many years people have influenced forest regeneration by grazing animals in Bugoma Forest, and field observations confirmed young boys grazing cows and goats in Bugoma. More recently, and particularly since the arrival of refugees, both communities are cultivating crops in and around the forest and wetlands. This includes large landholders growing cash crops such as tobacco, as well as smallholders growing food crops 'deep in the forest' [Bob, host] which affects the provision of fresh water. As a local resident explained: *'People are planting crops like cabbage, tomatoes in the swamps especially during the dry season. Before, those swamps would be flowing with water, but right now they have all dried up.'* [Oba, host]

Host community members noted that cropping on the floodplains of River Masika, for example, is a learned practice from Rwandan refugees, and that Ugandan outsiders are renting land in and around the settlement's wetlands in order to grow these high value crops. The District Environment Officer stated that most of Kyangwali's wetlands have been encroached upon, with the government now more actively preventing cropping in Bugoma Forest and wetlands areas.

These practices are likely specific to our case study villages and their location, as survey data covering a wider settlement scale indicates low numbers of people cropping in forested and wetland areas.

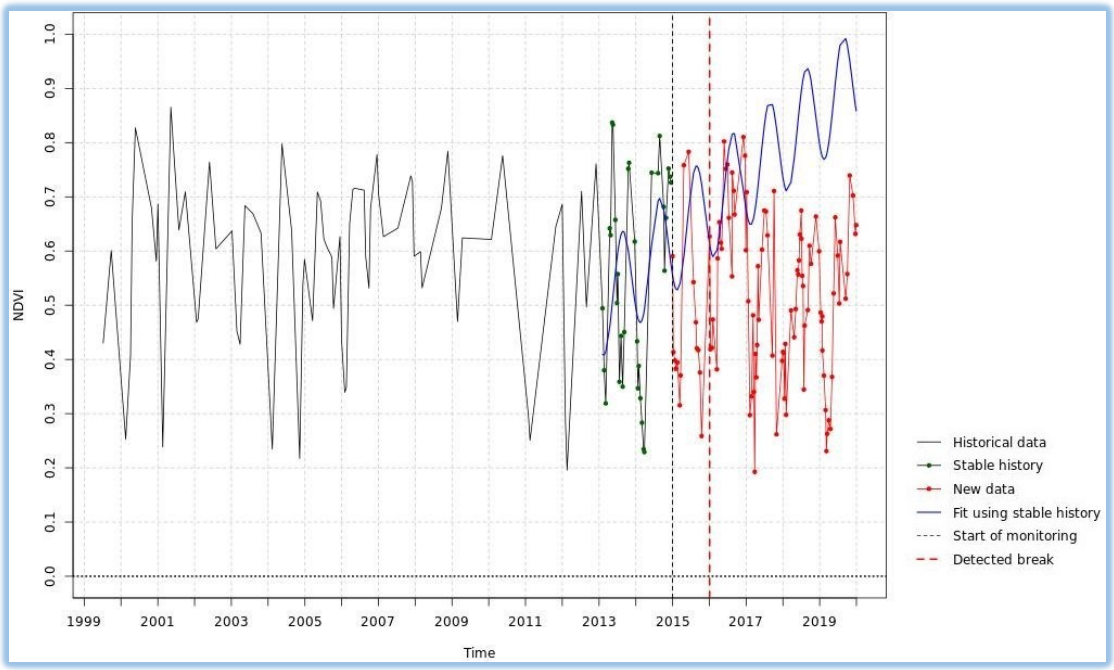


Figure 10. Time series NDVI analysis (BFAST) for whole of Kyangwali settlement, with breakpoint detected in 2016.

4.1.2 Bugoma Forest change, access and exploitation

The extent of tree cover in Bugoma Forest adjacent to Kyangwali Refugee Settlement has decreased by 7.5% between 2015 and 2021, with increased fragmentation, decrease in habitat connectedness and a reduction in the mean size of remaining patches by 50% (Figure 11). These metrics corroborate perceptions that tree cover in Bugoma Forest immediately adjacent to Kyangwali is reducing and becoming more fragmented, which will have direct impacts upon biodiversity and forest resilience to further disturbance.

The changes in land cover observed between 2015 and 2021 (Figures 8 and 9) are also corroborated by residents. Host communities attribute these landscape changes to refugees, particularly the reduction in tree cover in Bugoma Forest bordering the settlement. One woman explained her perceptions of environmental change in the area:

'The Bagegere who are the new arrivals, they are the ones who have really cut down the trees in the forest. […] they cut down the trees and put their gardens because they live very close to the forest.' [Mega, host]

Refugees also pointed to drastic tree cover reductions in recent years, explaining that 'you could just go behind your house and get a tree' when the population was relatively small [Ham]. Others noted that 'when we had just arrived you could see many trees on the other side of Kavule, but all those trees are not there anymore' [Timo]. On the other hand, some respondents felt there has been a regeneration of trees in the settlement as a result of tree planting initiatives. These views were supported by an OPM employee working on the ground in Kyangwali who told us:

'If you happened to be here around August, September last year and you saw the status of the forest and then look at it today, then you would tell the change. [Before] you would see bare ground. Today as you move there you can at least see some green. So, it is a sign of regeneration. It is a sign of some big change.'

The presence of refugees has also altered community dynamics of forest access. As a central reserve, access to Bugoma Forest has long been restricted. However, host communities noted that access restrictions have only been in place over recent years, coinciding with new refugee influxes. Due to increasing demand for firewood, authorities have introduced a byelaw permitting refugees to enter the forest on Wednesdays to collect dry firewood. The cutting of living trees is forbidden, and people are not allowed to carry pangas or machetes into the forest, rules which are enforced by government forest rangers and community forest officers on the ground. Despite restrictions, both refugees and hosts said they entered the forest illegally. One respondent explained how they had found ways around these forest access restrictions:

'I go to the forest [on] Saturday or Sunday when we are sure that the rangers are not there. They only work during the weekdays.' [Rose, host]

Others said they bribed government forest rangers in order to 'smuggle' forest products such as timber, grass and firewood. For many households unable to collect enough firewood on Wednesdays, illegal forest entry is the only option, as explained by a refugee:

'When our firewood is done and we don't have money to buy more, we go and steal from the forest.' [Barack]

Demand for firewood is high and appears to be the biggest driver of deforestation in this part of Bugoma Forest. Elders from the host community said refugees have 'depleted all the firewood which we used to get from within the village', and that 'the trend of going to the forest to pick firewood was brought by the refugees' [William].

Firewood collection from Bugoma Forest, Kyangwali.

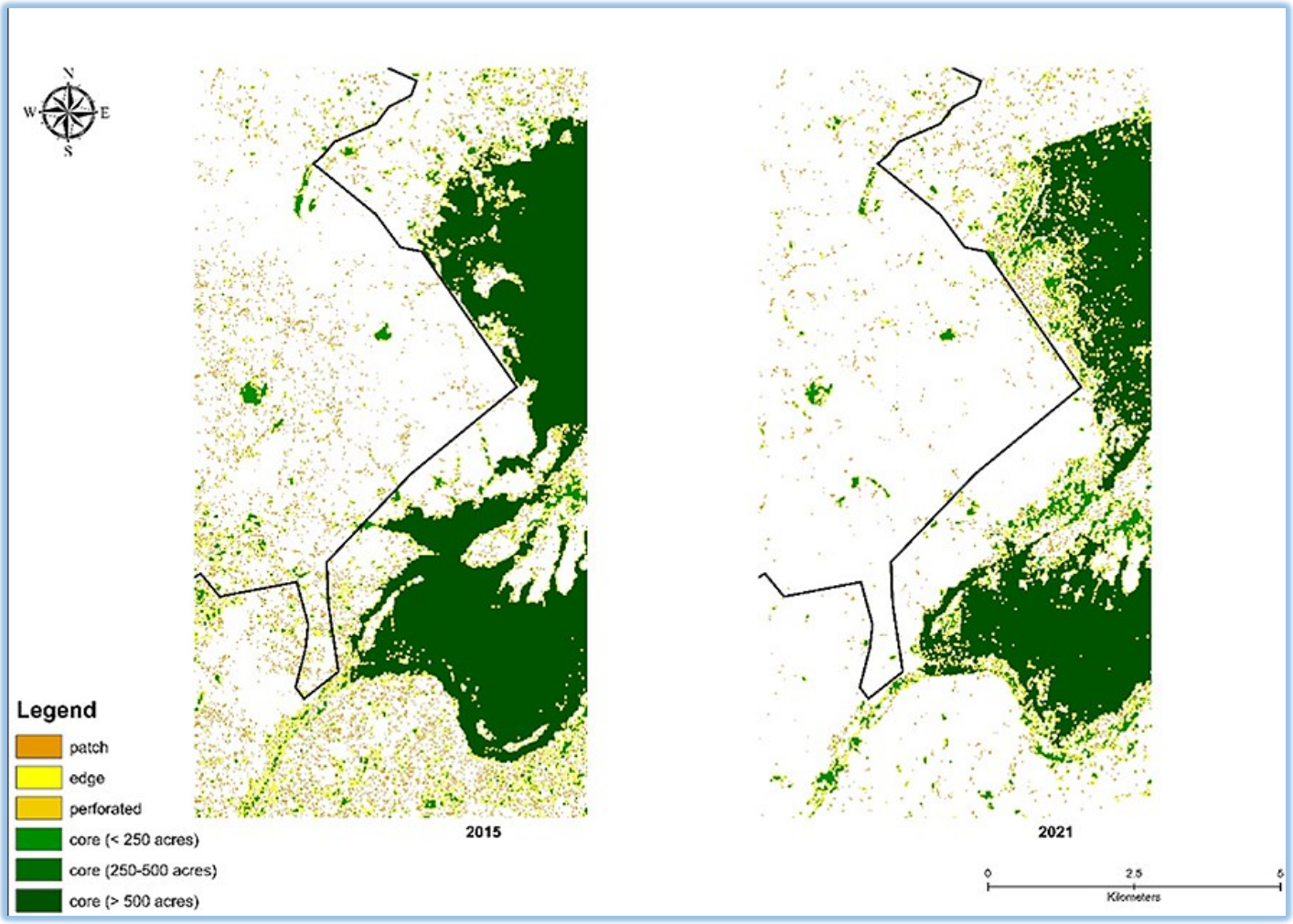


Figure 11. Change in forest extent in Bugoma Forest adjacent to Kyangwali settlement from 2015 to 2021.

As such, stakeholders working on the ground state that the availability of firewood is the biggest problem, both in terms of satisfying household fuel needs and the wider market. Survey data indicates that 48% (n=238) of hosts and 25% (n=122) of refugees collect firewood daily, and there are those who go back and forth from Bugoma Forest on Wednesdays (or enter illegally on other days) in order to collect enough for sale in local markets. 2% of refugee households listed selling firewood as a livelihood activity, compared with less than 1% of host households, and observations indicate that this is mainly an activity undertaken by refugee women who split the logs and transport them to Lake Albert where they are sold and used to dry fish. Cutting fresh trees for firewood also takes place, with particular species being targeted that burn more slowly and are more suitable for firewood [Milly, refugee].

Charcoal production is also a contributory factor in tree cover decline, despite low participation numbers at settlement scale. Only 4% (n=19) of host community and 2% (n=12) of refugee households said they had produced charcoal in the past year, and less than 1% of all households listed it as an income generating activity. Yet there is high demand for charcoal in the settlement, and respondents noted that 'there is money in burning charcoal' [Frank, host], with sacks of charcoal selling for around 50,000 Ugandan Shillings (equivalent to around £10 GBP). Some host households with access to mature trees employ others, including refugees, to produce charcoal for sale. This activity also takes place in Bugoma Forest, where abandoned charcoal kilns were observed. Despite often admitting producing charcoal from trees on their own land, hosts largely apportion blame for forest destruction to new refugees that are accused of cutting trees for charcoal. A woman respondent argued:

'I will tell you that the Bagegere have destroyed the forest. When you go to the market you see them selling charcoal, but where do they get the charcoal from if they are not cutting down trees?' [Venny, host]

Demand for construction poles for dwellings also drives tree loss. Refugees in Kyangwali are provided with four to six poles upon arrival, yet government admits this is

not enough to build and repair their houses (MWE 2019). Although most households buy timber when needed, 7% (n=31) of host community households said they obtained poles from the forest, compared to less than 1% of refugees. Local men explained going very deep into the forest to find 'strong' trees for construction, and during a forest walk on a Wednesday men were seen carrying large logs that had clearly been cut. When asked about this, one man told us:

'I know that what am doing is not allowed but I wanted just to construct my latrine. So that is why I also benefitted this day for women to come to collect firewood' [Peter, host]

Additionally, there is some confusion over the extent to which tree felling in the forest is 'commercial' or concession logging. Respondents mentioned timber dealers from Kampala, Masindi and Kabale coming to extract timber from Bugoma forest or paying locals to do it for them. There are also allegations of collusion with local officials and forest guards. Others reported large trees being cut, loaded onto trucks and transported to Kampala. A community forest guard also recalled hearing a lumbering machine in Bugoma and contacting the police to arrest individuals felling trees. Mahogany species, including trees that could be over 100 years old, are particularly sought after because of their strength, but communities say they are increasingly scarce. For many residents, these activities and their associated negative environmental impacts are a 'natural' product of the local context.

Forest encroachment is a necessity stimulated by poverty and a lack of access to natural resources and alternative livelihood strategies. As one man explained: 'The population doesn't earn [money], so all eyes are on the forest to see what they can do, whether burning charcoal, timber or anything to earn a living' [Denis, host]. These trade-offs do not only play out in the forest, and host community interviewees described having 'no other option' but to fell large mango trees on their own land to make charcoal which would last two or three months through the rainy season [Nicholas, host], while Silvester [host] asked 'How can I sleep hungry when I have trees?' Lacking land and other livelihood capital, the situation is more difficult for refugees who described cutting trees because their lives 'depend on natural resources and the forest' [David]. As Vincent [refugee] explained: explained:

'Back home in Congo [we] were doing business to survive or even casual labour. But here we don't have anything to do to earn. That's why people were cutting those trees.' [Vincent, refugee, Kyangwali]

RA (left) talks to loggers in Bugoma Forest, Kyangwali.

4.2 Environmental Change in Bidibidi

Remotely sensed data of Bidibidi indicates an increase in residential areas and bare ground. These include roads, construction sites, and settlement infrastructure, as well as land that has been cleared in preparation for conversion to another land use or that has yet to regenerate (see Figure 12 and Table). This loss of vegetation cover is influenced by infrastructure development to support the needs of increased refugee and host community populations, both in and adjoining the settlement.

4.2.1 Farming challenges in Bidibidi

Host communities feel they are now outnumbered by refugees, elders in one village noting 'there is no space for more refugees' [Yahaya]. Despite an increase in land under agricultural production (Table), host communities perceive available farmland to be reducing, with concerns there will not be enough to pass on to their children to inherit, as noted by one male respondent: 'I have children who would also want to carry out agriculture, but the land is not enough', [Arasi, host].

For refugees settled on small parcels of rocky, unproductive land, subsistence farming is even more challenging. In the village where interviews were conducted refugees have been allocated under-utilised 'hunting grounds' deemed unsuitable for agriculture by

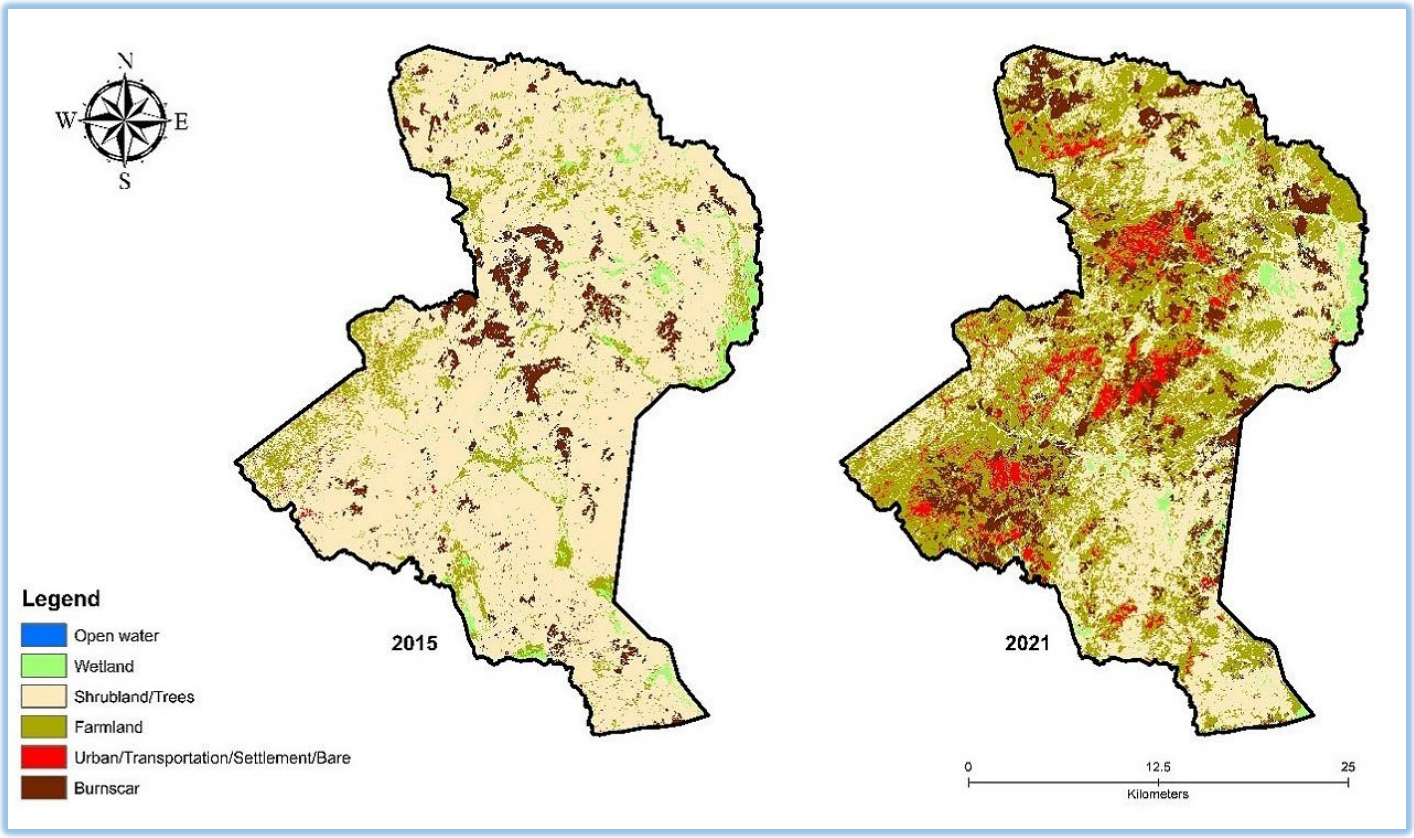


Figure 12. Land cover maps of Bidibidi derived from Sentinel-2 images acquired in 2015 and 2021.

host communities (Boswell 2018), and refugees are forbidden from encroaching beyond boundaries demarcated by host landowners. Access challenges to productive land are exacerbated by climatic conditions hostile to agriculture; during the pilot survey 74% (n=52) of respondents flagged a lack of rainfall as a main farming challenge. A refugee commented:

'In South Sudan we start planting by March, but here the rain season delays so we start planting in May, sometimes June. That's why there is a difference. Here […] the land is hard, you can't dig much. Our land in South Sudan is fertile, the yield is better and we plant early.' [Tonny]

These challenges may help to explain the increased prevalence of bush burning in Bidibidi, which has almost doubled in terms of evidence of recent burn scars between 2015 and 2021. This impacts the semi-natural mosaic of land cover in the region leading to dynamic land cover change year on year. It is a contentious issue amongst communities, with only 8% of households (n=70) admitting to undertaking the practice. Some of this burning is done alongside deforestation in order to clear land for farming and to make firewood collection easier and safer in areas of thick bush. Cattle grazing is also a driver of bush burning, host respondents

Land Cover Class	2015	2021	Change
Wetland	27.4	21.9	-5.5
Shrubland, trees	655.7	310.2	-345.4
Farmland	69.0	331.7	262.8
Settlement, roads, bare ground	6.1	49.2	43.1
Burn scar	47.6	92.6	45.0

Table. Land cover change (km^2) within Bidibidi settlement from 2015 to 2021.

complaining that a shortage of grassland causes them to take their animals to graze deep in local forests and along seasonal rivers. Finding forage for livestock is particularly difficult in the dry season, and hosts such as Omar described 'rampant' bush burning in December to encourage new, nutrient rich grasses for their animals to feed on.

A lack of livestock ownership does not necessarily preclude refugees from participating in bush burning. Participatory mapping with older refugee men revealed an argument about whether to draw bush burning, fearing it would implicate them in this destructive

practice. In the end they decided to draw the activity on their map but said it was something they did in South Sudan, where they burned trees in their gardens that were too big to cut. On a local level at least, it appears bush burning is a coordinated activity between refugees and hosts, during which wild animals will be flushed out and hunted. As participatory mapping discussions with host community men revealed:

'Previously, there were places where there were many animals that were not allowed to be set on fire. But now, when the time comes for them to be burnt, people are informed to be ready because many animals will come out to be hunted. Many people come and surround the place and then it is set on fire.'

[Abubaker, host]

4.2.2 Tree cover change and forest exploitation in Bidibidi

Landscape fragmentation and tree cover loss in the settlement has changed significantly between 2015 and 2021 (Figure 12). Land cover, representing trees and shrubs, has reduced by more than 50% (Table) within the settlement and surrounding 5 km area, whilst the mean patch size of remaining tree covered areas has reduced to just 11% of the 2015 value, suggesting increased fragmentation and loss of connection between patches of tree covered areas. This tree cover loss and woodland fragmentation was exemplified during a participatory mapping exercise with refugees when discussing the 'forest' they had drawn:

'It is not a big forest; we actually call it a bush because we don't have big trees and we don't have congested trees that are in one place. We put those trees for the sake of talking about a forest.' [Adrian, refugee, Bidibidi]

Tree loss is driven in large part by demand for firewood amongst both communities, borne out by our survey (Figure 7) and in previous studies (e.g. World Bank, 2019b). A wood fuel assessment undertaken by FAO and UNHCR (2017) found that aboveground biomass would meet the demands of Bidibidi's population for only three years. A lack of alternative cooking fuels and technologies increases dependence on firewood and the rate of its depletion, MWE (2019) reporting that only 45% of refugee and 20% of host households use energy-saving stoves. In the household survey less than 1% (n=4) of all households listed gas or other fuels as their main fuel source. As one refugee indicated, 'if you do not cut trees, you do not eat food' [John].

At settlement scale, 81% (n=399) of refugee households collect firewood in host community areas or outside of their own village. In the case study village, refugees originally collected firewood from a neighbouring 'place without people' that had been allocated to refugees but in which nobody had settled. However, the trees there were exhausted after a couple of years as refugees used them for firewood and building materials. Refugees are unable to use this land for farming because it has been gazetted for cattle grazing by the hosts, perhaps underlining the paucity of grazing land in the area, highlighted by the reduction in the shrubland/trees land cover class (Figure 13). Refugees now travel to host community areas to negotiate access to firewood, and during participatory mapping discussions refugees described walking several times a week to collect dry wood for cooking from distant host community villages and forests in Kululu sub-county and Zone 4. As one woman explained:

'We used to collect the firewood from within, but now we have to go very far beyond the homes of the Aringa. Sometimes we move for about four to five miles.'

[Kenji, refugee]

A boy fells a large tree, Bidibidi.

These findings support previous research which suggests that tree loss is more prevalent in host community locations in the region and not simply in and around refugee settlements (FAO and World Bank Group 2019).

Survey results indicate that refugees collect firewood less frequently than hosts, with 69% (n=338) of refugees collecting once or twice per week, whereas 66% (n=328) of host community households do so three times a week and more. This is likely a result of hosts having easier access to closer firewood sources that they are able to access regularly. Yet data from the case study village indicates that firewood collection practices have also changed for host communities in recent years. People living there blame refugees for the lack of access to firewood, stating 'the Sudanese have cut most of the nearby trees for charcoal' [Twaha], and that 'refugees have destroyed most of the trees' for firewood [Aisha], charcoal production and 'the business of alcohol brewing' [Hassan]. This means hosts must now collect firewood from places up to two miles away. Due to the lack of dry branches both communities are resorting to cutting fresh trees for firewood, preventing natural forest regeneration (George and Dearden 2019). As explained by a female respondent:

'When you go to the bush you do not get the dry firewood, so we cut the trees we are not supposed to cut […] and take them home to dry' [Shifra, host].

Similarly, refugees said they have 'reached the extent of cutting a live tree' for firewood [Janat], children admitting cutting all kinds of trees apart from the Shea nut because the locals use if for making oil. Although very few households listed it as an income generating activity, firewood is also sold, particularly by hosts as a livelihood strategy outside of farming seasons.

Charcoal production also drives landscape change in Bidibidi, with 28% (n=142) of host community and 3% (n=15) of refugee households undertaking the practice. The majority produce charcoal for household use, but it is also sold in local markets and transported to larger urban centres such as Arua and Kampala (George and Dearden 2019). The Senior Environment Officer in the District Government reported that charcoal production is prevalent in Yumbe because of its high poverty levels, whilst Bidibidi's settlement commander stated that charcoal is 'big business', and that charcoal sourced there would make large profits once sold in Kampala.

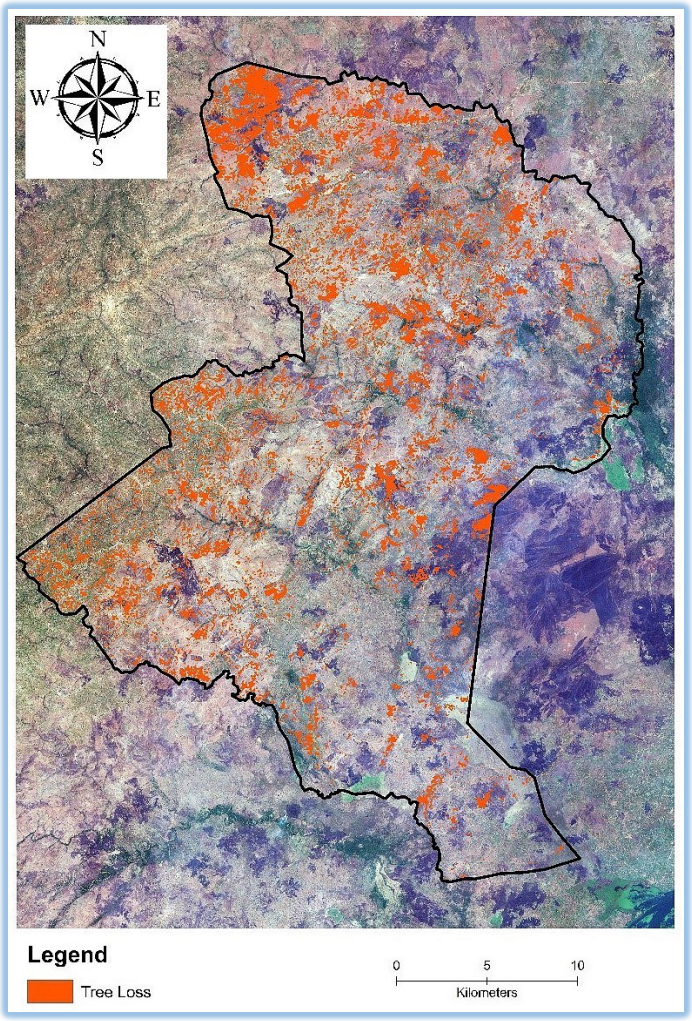


Figure 13. Loss of tree cover, Bidibidi Refuee Settlement derived from Sentinel-1 SAR images between 2015 and 2021.

For that reason, he argued people will not be prevented from burning charcoal, 'even if you brought the whole UPDF to protect the forest'. 5% (n=23) of host households specified charcoal production as an income generating activity, often undertaken in response to crop farming challenges, as one man explained:

'Those years when yields were high you could not think about burning charcoal, but now the yields are poor and this forces you to look for ways to make money' [Mubarak, host].

Despite no refugee households listing charcoal production as an income activity, interviews at local level shed light on its importance in generating household revenue. A refugee woman explained how her husband produces charcoal to support their family:

'When things are hard, he asks for trees from the locals for burning charcoal, and when he burns about two sacks he sells to help the family. […] He cuts the trees by himself, they only tell him which trees to cut and how many to cut. […] After cutting the trees into pieces he

piles them, then puts some grass on top of the trees and covers it with soil, leaving a small hole for lighting and later closes it after which they are allowed to burn. […] He sells them. We don't use it for cooking because we need money. […] He carries them to the roadside and sells.' [Fridah]

Participatory mapping with the host community revealed that they make charcoal from mature trees found in Buya Forest, refugees having to travel into host community villages to access mature trees for charcoal burning.

In light of firewood access challenges, demand for charcoal is increasing amongst refugees who described having no option but to buy it from hosts. Undoubtedly local communities were producing charcoal prior to the refugees' arrival, but it seems this activity has increased in recent years, becoming a 'daily activity' for some [Nasser, host] in order to satisfy new demand. This may partly explain the significant decrease in tree cover (Figure 13), especially in and around host community lands (FAO World Bank Group 2019). Among survey respondents, most host and refugee households making charcoal said they did so monthly or every few months (82% of nationals [n=122] and 87% of refugees [n=14]). Some refugees said they produced charcoal when they first arrived in 2016 and 2017 but have not engaged in the practice since then due to a lack of trees. Complaints were more regular amongst hosts who attributed indiscriminate tree cutting to refugees, meaning there are 'no big trees around […] these days' [Fred]. This makes charcoal production 'impossible' [Hussein, host], forcing people to cut smaller trees for firewood and adopt alternative livelihood strategies such as casual labour.

Wood for sale, Yumbe town, Bidibidi.

The extraction of old trees for commercial timber production also reduces tree cover in Bidibidi. Local village leaders as well as stakeholders from OPM and Yumbe's Resident District Commissioner (RDC) explained how business people from Kampala and elsewhere negotiate with local councils and landowners to undertake logging (NEMA 2017). African mahogany (Khaya spp.) is particularly targeted due to its economic value, with locals and refugees being employed to fell trees. According to the village chairman, these 'mili trees are now over'. There is also smaller scale logging to satisfy household timber demand, particularly amongst refugees. 57% (n=279) of refugees collect timber outside of their village or in host community areas, and 63% (n=306) had done so at least once in the past week. 38% (n=185) of refugees also buy timber, and interviewees described buying poles harvested by hosts and sold at a timber market in a neighbouring village [Denis, refugee].

The increase in bare areas and loss of tree cover (Figure 13) is also driven by livelihood activities including stone quarrying and brick making. Some hosts assert that stone quarrying was introduced by refugees, but it is primarily carried out by host communities; in the household survey in Bidibidi only 5% (n=35) of refugee households undertake stone quarrying, whereas 12% (n=61) of local households do so, most of whom were quarrying prior to refugee arrivals. These livelihood strategies are mainly undertaken outside of the cropping season when 'people are not so busy and end up doing quarrying' [Twaha, host]. For refugees in particular, stone quarrying is a response to farmland access issues, as Abu explained:

'When I wake up in the morning I go and dig. Later I go for stone quarrying because the land is not enough to cultivate. When the stones are one full trip vehicles come and buy which helps my family' [Abu, Bidibidi]

While most people quarry stones in their villages, respondents also explained they sometimes quarry in the forest because of the larger stones that can be found there, making the arduous labour involved more worthwhile.

Similarly, large trees are required and targeted for burning bricks. At settlement scale only 1% (n=7) of host community households and less than 1% (n=1) of refugee households specified brick making as an income

generating activity, yet it was clearly observed in the case study villages throughout the year. Refugees are not permitted to construct their dwellings with burnt bricks, yet interviews revealed that bricks are often produced and sold to implementing partners and local entrepreneurs are encouraged to 'source local materials from within' for infrastructural development projects (personal communication). Alongside fuel demand, poverty and a lack of alternative livelihood strategies, these factors have led to 'very serious cutting down of trees' in Bidibidi, as one UNHCR employee put it.

4.3 Summary

Population increases in both locations is resulting in environmental change, tree loss and fragmentation of vegetation cover in favour of residential and agricultural land. The complexities of how host communities and refugees engage with ecosystem services in Kyangwali and Bidibidi indicates that livelihood practices are insufficient and not sustainable to meet the needs of those living there and for the forests to thrive.

Practices including charcoal burning, bush burning, stone quarrying and brickmaking, used to supplement subsistence livelihoods, further exacerbate environmental change around high-density population refugee settlements. Section 5 will now explore what the data contributes to creating sustainable livelihoods for both local and refugee populations in Uganda.

5. CREATING SUSTAINABLE LIVELIHOODS

This section seeks to understand barriers and challenges to creating sustainable livelihoods for both refugee and host communities. By understanding not just the drivers of environmental change (Section 4) but issues such as access to land, policy impacts, governance structures and community relations, positive actions may be identified that can aid building of sustainable livelihoods for both communities.

5.1 Access to Land and Natural Resources

Access to agricultural land and natural resources is a livelihood challenge for communities in both settlements. Yet these dynamics differ between sites as a result of specific settlement contexts and land ownership arrangements.

Brick making, Bidibidi.

5.1.1 Access to farmland

Host communities often express farmland access challenges as concerns for future generations, particularly in Kyangwali where fertile land has been allocated to refugees. For refugees, farmland access is a more pressing challenge affecting daily household subsistence. At both sites there are marked differences in land ownership between refugees and hosts (Figure 14). Since the 2017-2018 refugee influx in Kyangwali plot sizes are reducing for new refugees (UNHCR 2018b). 53% of refugees (n=275) there have less than a quarter acre or no land at all, whereas 67% of host community households (n=310) have one acre or more. In Bidibidi OPM was unable to allocate 50m^2 plots due to overcrowding, refugees instead being given 30m^2 plots (Boswell 2018). Over 70% (n=348) of hosts have access to more than one acre of farmland in Bidibidi, compared to only 8% (n=39) of refugees, 51% of whom (n=250) have less than a quarter acre of farmland. As an employee from Save the Children noted, refugees in Bidibidi have to use their 30m^2 plots 'for food production, home construction, for their compound where the children will play and for any other kind of services they need, which is not sufficient'.

At both sites refugees borrow or rent land from hosts to make a living, although this is much more common in Bidibidi where 25% (n=123) of refugee households grow crops in host community areas, often far from their own village. For hosts this is a welcome arrangement, refugees providing a cheap source of labour on land that is perhaps too big for one host household to manage.

However, refugees may find themselves exploited as a consequence of these arrangements, as a refugee in Bidibidi explained:

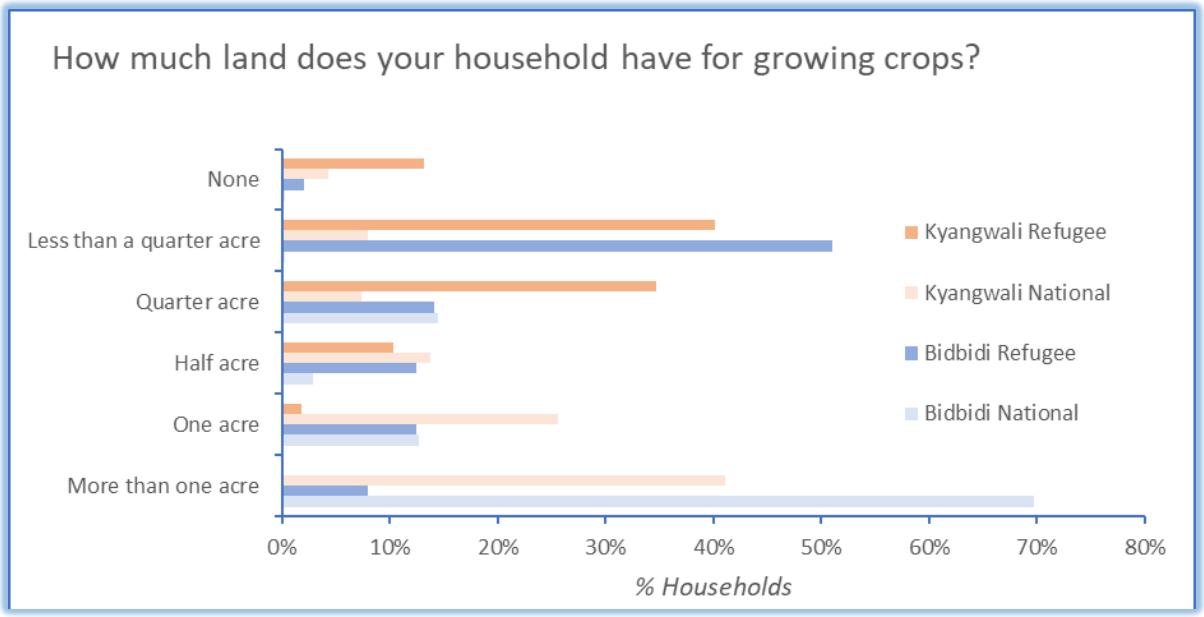


Figure 14. Household survey responses to the question "How much land does your household have for growing crops?"

'Coming to an agreement with the nationals, you pay some money then they give you a piece of land to use for cultivation. However, not all these nationals are honest. Most of them are dishonest. After cultivating the land and […] the crops are ready for harvest, they deny you the rights to take part of the harvest. Maybe they come to take some of the crops [as well as] you paying them money for that piece of land. So it is quite challenging. And some of them may deny you completely the harvest. They just grab the harvest for themselves.' [Richard]

Conflicts between communities over farmland access and produce are common at both sites, but more frequent in Bidibidi. Tensions there are worsened due to refugee crop losses caused by cattle and goats belonging to host households. 84% (n=420) of host community households own or look after cattle or goats in Bidibidi, compared to just 23% (n=113) of refugees. In Kyangwali only 34% (n=159) of host households possess cattle, again highlighting the contrasting land and resource pressures between sites and resultant impacts on refugee-host relations. A male refugee in Bidibidi recalled confronting livestock owners after his crops were destroyed but was told 'you have come for refuge here, not to dig' [Andrew]. Other refugees there stated that host communities 'do not want us to dig their land' [John] and that 'the owners of the land do not expect us to extend from where we were given' [Chris]. According to a local government employee, host communities 'offered the land out of goodwill to settle brothers and sisters', emphasising refugee dependence on host communities for farmland access.

Farming challenges particularly impact refugees who have previously relied on crop farming and animal husbandry as primary livelihood activities. 'The problem for me in Uganda is the lack of land to farm, yet that is all I know how to do,' noted a refugee in Kyangwali [Barbara]. At both sites refugees often talked about having more land, growing a greater diversity of crops, and keeping many animals back home. Lack of capital to purchase animals and land to graze them are prohibitors; those that keep animals in Bidibidi often have to pay for access to grazing land and refugees' cattle can be stolen from common grazing areas. Some refugees in Kyangwali spoke about relying on non-farming livelihood activities in DRC, including doing business in urban areas. As such, farming barriers arguably inflict a greater burden on refugees in Bidibidi, but both communities are impacted in different ways.

Livestock are owned by 84% of local households in Bidibidi.

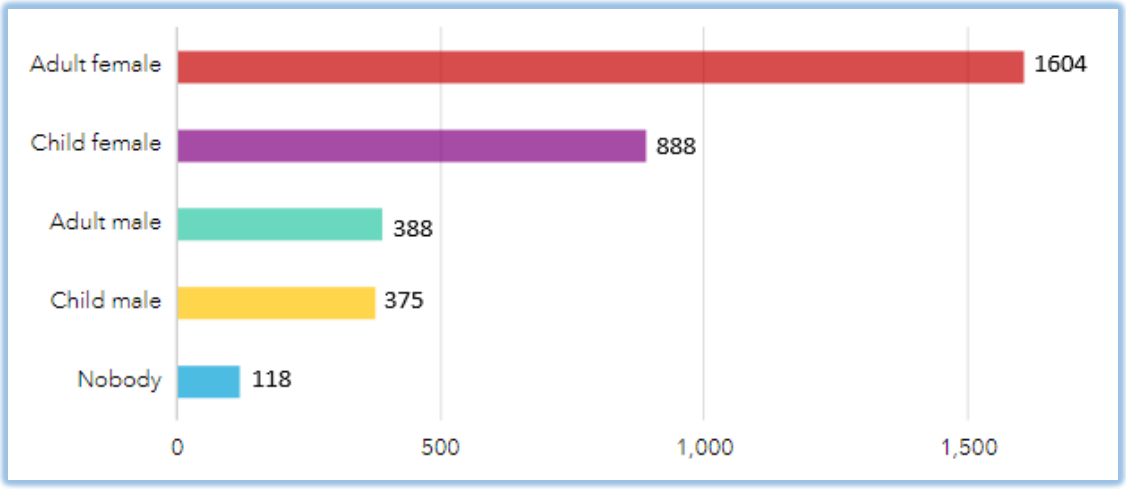


Figure 15. Household survey responses to the question "Who collects firewood in your household? (Select all that apply)" shows fuel wood gathering primarily falls to women and girls in both sites.

5.1.2 Natural resource access and conflict

The pilot survey revealed that 83% (n=116) of households specified access to natural resources as a main livelihood challenge. Refugees claim it is more difficult to access forest resources in Uganda compared to their country of origin, with 97% (n=34) of refugee households in Bidibidi and 83% (n=29) in Kyangwali finding accessing trees more difficult. Compared with Bidibidi there is arguably less 'direct' competition in Kyangwali, with both communities having limited, but equal, access to Bugoma Forest. Yet forest access restrictions in Kyangwali impact on livelihood options for hosts and refugees. Charcoal production is slightly less common when compared with Bidibidi, likely a result of relatively strict protectionist policy in Bugoma Forest. But regulations appear to have the greatest impact on livelihoods from timber, with the collection of poles from Bugoma Forest being proscribed. 43% of host households and 76% of refugee households said they did not collect timber, one man stating: 'I want to construct another house for my family but there are no poles to use' [Abwoli, host]. 37% (n=173) of host households buy timber from markets, but only 24% (n=119) of refugees do so. A refugee boy explained: 'we don't have money to buy poles from the market', and that forest guards 'don't allow us to get timber for our construction' because they suspect people will sell it [Dewi, Kyangwali]. Concurring with this, a host community member in Kyangwali noted: 'there is money in lumbering, but because we don't have access to the forest, we can't do it' [Amooti]. Although some refugees were provided with poles upon arrival, many households need to (re)build houses but lack access to trees. Despite their own challenges, hosts are empathetic to the refugees' heightened vulnerability:

'When I want to construct my house there are many trees within my land which I can cut down. But the poor refugees, where can they cut trees from? What do you expect them to use to build their houses?'

[Jimmy, host, Kyangwali]

Yet for host communities and refugees alike in Kyangwali, there are risks associated with seeking forest products. Respondents mentioned the threats posed by wild animals, particularly snakes, as well as the risk of accidents and getting lost in Bugoma Forest. However, the biggest danger is the prevalence of gender-based violence; communities complaining about the heavy-handedness of government forest rangers that beat and rape. Young men explained during a group discussion

Women returning from collecting firewood, Bidibidi. Firewood is a universal need among host and refugee communities, chiefly collected by women and girls (Figure 15).

Cleared garden adjacent to Bugoma Forest, Kyangwali.

that 'even on Wednesdays [the rangers] go at the points of exit, and if you get out with a pole they can beat you up seriously' [Stephene, refugee, Kyangwali]. Women have been particularly affected by this increased violence, fearing to enter the forest to collect firewood and other natural resources used to generate income such as weaving materials. One elderly woman explained:

'We really fear going into that forest. […] we also fear the rangers, because once they find you there, they just beat you up. And for an old woman like me who has no energy to run out of the forest when the rangers start chasing people, I just don't go there completely.' [Lucie, refugee]

There are also claims of rangers raping women in the forest as discussed during participatory mapping, a young woman noting:

'Of course, the women will not come out and say that they were raped, but we hear rumours that rangers rape people' [Jonah, host].

Men also claimed that while their wives 'do not talk', women often feel obliged to 'negotiate and have sex with the rangers' in order to access the forest products they need [Apuuli, host, Kyangwali]. Men recalled a meeting in which organisations suggested that 'women need to be more vigilant' [Atenyi, host] indicating that they may be aware of the crimes but place the onus on women to resolve it.

At the case study site in Kyangwali natural resource access issues thus emanate largely from interactions and conflicts between communities and state actors, especially government forest rangers. While there are intra-community tensions, refugees' close proximity to Bugoma Forest means they are relatively autonomous from neighbouring host communities. The social dynamics in Bidibidi are different, with refugees being more dependent on host community legitimisation and interaction for access to natural resources, resulting in increased intra-community competition and conflict (Boswell 2018). As an employee from World Agroforestry stated, 'these environmental challenges transition into social issues, where you find fighting: don't touch that tree, don't chop that'.

This has resulted in significant differences between refugee and host community access to natural resources in Bidibidi. At settlement scale 66% (n=331) of host households collect firewood from their own village or host community areas, whereas the vast majority of refugees must try to source fuelwood from outside their village or in host areas. This can be contrasted with Kyangwali where 50% (n=260) of refugee households collect firewood from their own village, and 21% (n=107) obtain it from the forest. As discussed in section 4, refugees in Bidibidi are now having to venture into host community areas to access trees, some even traveling into local council areas that have not allocated land to refugees or have not been compensated by OPM for doing so. As one refugee noted:

'We are pushing out to areas where the landlords were not paid something to compensate the natural resource to be used […], then we get the challenges that those people don't accept us to use their natural resources' [Brian, refugee, Bidibidi].

Refugees are often chased away by host communities from accessing these resources, the alternative being to pay or to trade their food rations. There are also allegations of gender-based violence and rape when women attempt to collect firewood in remote areas, claims that are also reported in other studies (Boswell 2018; Dawa 2019; FAO and World Bank 2019b). With increased distances to firewood sources that hosts control, more refugees in Bidibidi are forced to purchase fuelwood, with 12% (n=59) of refugee households buying or trading goods for firewood compared to just 1% (n=8) of host households. In Kyangwali only 3% (n=14) of refugee households buy firewood, and none stated that they trade goods in exchange. As Boswell (2018) notes, the more 'ad hoc' firewood collection

practices in Bidibidi perpetuate refugee vulnerability.

Similarly, there is great demand amongst refugees for timber, yet in Bidibidi 42% (n=204) obtain it from host communities, and 38% (n=185) buy it from local markets. In our case study village refugees described buying timber from hosts in a neighbouring village and expressed regret at their inability to also generate income from timber sales, one respondent asking 'where can we get the trees? We don't have the trees to cut' [Omar]. Their lack of access to trees also means refugees are less likely to make charcoal. As a young refugee man explained, hosts 'go deep to burn charcoal' [Umaru], into remote areas that are inaccessible to refugees alone. For those refugees that travel to these places and work alongside hosts to make charcoal, these relations of production are often very unequal and exploitative.

Refugees in Bidibidi also claim that host communities created a 'border' in 2018 to prevent deforestation in their areas which had worsened since the refugees' arrival, and that hosts 'mark' particular trees with paint that should not be cut. Similar claims were made by refugees in Kyangwali, albeit against government officials rather than host households. Tree marking is in fact undertaken by implementing partners with UNHCR support, trees painted with different colours to signify their biodiversity/economic value and protection level. This is intended to be a participatory process with local communities, yet refugee perceptions at both sites illustrate their lack of involvement in the crafting of rules relating to natural resource use and management.

At both sites natural resource access issues impact individuals and households in different ways, depending on various factors. In Kyangwali households with family members fit enough to make multiple trips to the forest on Wednesdays are able to collect enough firewood to last the week, or even collect surplus for sale. Yet households with elderly and vulnerable members that are perhaps located further from the forest are unable to do so. A refugee man indicated that trade in firewood 'should not even be looked at as business, but just a way of helping those people who cannot go into the forest' [Victor]. This is not only an issue affecting refugees, a woman from the host community explaining that she 'cannot carry heavy things anymore because

Mature jackfruit tree, Kyangwali.

I have problems in my chest' [Sarah], and is therefore dependent on buying charcoal.

The lack of access to natural resources is demonstrated to be a major challenge for both host communities and refugees across both sites. This section has delved into the nuances of these human–environment interactions to explore the various challenges faced by individuals and households at either site. Further, the complexities of access to natural resources over burden refugees who have much reduced access, particularly in Bidibidi.

5.2 Environmental Governance and Programming

This section considers efforts to mainstream environmental protection within the refugee response, and the efficacy of these programmes as a means toward combatting degradation and fostering sustainable livelihoods. It also seeks to understand the current impacts of policies, programmes and institutional arrangements for refugee and host communities, and where they might be adapted to better realise the twin goals of refugee protection and environmental conservation.

5.2.1 Mainstreaming environment in refugee programming

The link between environmental change and livelihood sustainability is recognised by stakeholders, and conservation objectives have been incorporated into refugee policy and programming. Uganda's most recent National Development Plan (NDP III) acknowledges the negative impact of environmental degradation on development objectives, identifying the urgency of natural resource management and environmental protection as a key programme (NPA 2020). Aligned to NDP III is MWE's Water and Environment Sector Response Plan, covering the period 2020/21-2025/26, which stresses the need for all partners involved in the refugee response to integrate environment mitigation within emergency preparedness across all sectors (MWE 2019). To that end, Uganda's Refugee Response Plan identifies environmental protection and restoration as a priority outcome (OPM and UNHCR 2020). The former interim Commissioner for Refugees in OPM (2017-2020) explained that policy clearly outlines that 'every government entity in the refugee response must have at least 5% of its resources dedicated to an environmental restoration programme'. Funds are provided by international institutions such as the World Bank, and stakeholders note a shift in policy focus from livelihoods to environment:

'when we started we were basically focusing on livelihoods and cash-based interventions… but now our […] main initiative is environment and energy which wasn't on the radar for refugee response' [Staff member, DanChurchAid (DCA)].

5.2.2 Environmental knowledge and perceptions

Local community knowledges and values underpin socio-ecological interactions and influence household decision-making processes. As such, conservation objectives have involved environmental sensitisation and education, something which host communities argue is needed to reverse current degradation trends. 'The government has to come in with these local implementing partners […] to teach people about how to conserve their environment' noted a man in Kyangwali [Araali, host]. Similar requests were made in Bidibidi, a woman respondent claiming that both refugees and hosts 'need to be taught about the importance of big trees and the disadvantage of cutting them down' [Peace, host]. Interviewees demonstrated sustainable practices when harvesting forest products, knowledge which may be transferred between countries or learned from elders, government, NGOs, or school. For example, locals and refugees in Kyangwali explained how they only 'pick the branches left behind' [Carlie, host] and 'do not cut fresh trees' [Emmie, refugee] when collecting firewood. Communities also spoke about the value of trees, mainly in terms of the direct benefits they provide for fuel and construction materials. They also regularly mentioned the role of trees in climate regulation, particularly rainfall generation. Yet the link between forest cover and broader biodiversity seems less well understood and valued, particularly from a livelihood perspective.

Across both sites and communities there is a general recognition of environmental problems. Deforestation is understood as a critical issue, identified as the most pressing environmental problem in both settlements. Reduction in tree cover was mentioned in the pilot survey for both settlements, particularly in Bidibidi where communities are more pessimistic about future access to trees compared with Kyangwali. 71% (n=707) of Bidibidi survey respondents believe they will not have access to trees for firewood and timber in five years' time; this figure is 54% (n=527) in Kyangwali (Figure 16). Yet these changed landscapes are not always considered negative, particularly in Bidibidi where the arrival of refugees has brought roads, buildings and greater accessibility. As one refugee explained:

'When they first brought us here this place was a bush, but now we have made it better because we built houses and our place is now better than that of the host community' [Ausie].

Market day at Lake Albert, near Kyangwali.

5.2.3 Environmental restoration

Stakeholders have attempted to rectify deforestation through tree planting initiatives, and MWE targets planting 6 million trees annually across refugee settlements (MWE 2019). Refugees and host communities are provided with seedlings and encouraged to plant trees at home, in their communities and in designated woodlots. 'As much as possible we are trying to reemphasise afforestation […] to mitigate the impact of climate change and protect the ecosystems' noted a staff member from the Department of Refugees. Contrary to perceptions that refugees lack interest in longer term environmental initiatives such as tree planting, our study indicates that over the past twelve months 65% (n=317) of refugees had planted trees in Bidibidi, compared with 48% (n=241) of hosts. The numbers are lower in Kyangwali, where 32% of both refugee and host households planted trees in the past year. Differences between refugee and host participation may also result from implementing partners targeting refugee communities more than hosts.

Undoubtedly there is a desire to plant trees amongst residents at both sites, a refugee in Bidibidi saying they 'would love to be given teak, eucalyptus, and avocado trees because when they grow they can act as wind breakers and help in rainfall formation' [Fina]. Many respondents also wanted to plant fast-growing species that can benefit them sooner for household use or sale. Across both sites the main reason for planting trees is to provide firewood (30%; n=597), closely followed by the provision of food (28%; n=542) and timber (26%; n=519) (Figure 17). Interestingly, food provision is the biggest motivator for tree planting amongst refugees in Kyangwali, lending support to the idea that firewood access is easier, compared with Bidibidi. In both settlements refugees largely rely on being given seedlings by NGOs, whereas host community households also buy trees. As such, households with enough land do not wait to be provided with seedlings, instead buying from local markets to plant quickly. As one man from the host community in Kyangwali explained:

'I cut off a portion from my land and I reserved it specifically for tree planting. […] When the trees grow, if we need poles for construction we can use them [and] we will be able to sell them to other people who need poles. You see that house, I never bought any poles, I used my own trees.' [Shaul]

Many households, particularly refugees, do not have space to plant trees at home, and government acknowledges the availability of land to establish woodlots remains a challenge in refugee settlements (MWE 2019; OPM and UNHCR 2020). 'If you have two acres, when you plant trees you will remain with no land to cultivate your food' noted one refugee [Aggie], although communities have been encouraged to plant trees around the boundaries of their farmland if possible. Across both sites a lack of space was mentioned by 30% (n=596) of households that had not planted trees in the past year, second only to a lack of seedlings (38%; n=742). In Bidibidi there are complaints about a lack of monitoring and aftercare, trees dying because the land is too rocky or seedlings being provided at the wrong time of year. One man recalled 500 seedlings perishing after he was forced to plant them in the dry season [Moggie]. Refugees in Kyangwali have planted eucalyptus and bamboo on the Bugoma Forest boundary as part of cash for work programmes, but these non-native species may not replace pre-existing ecosystem services, especially with regard to biodiversity.

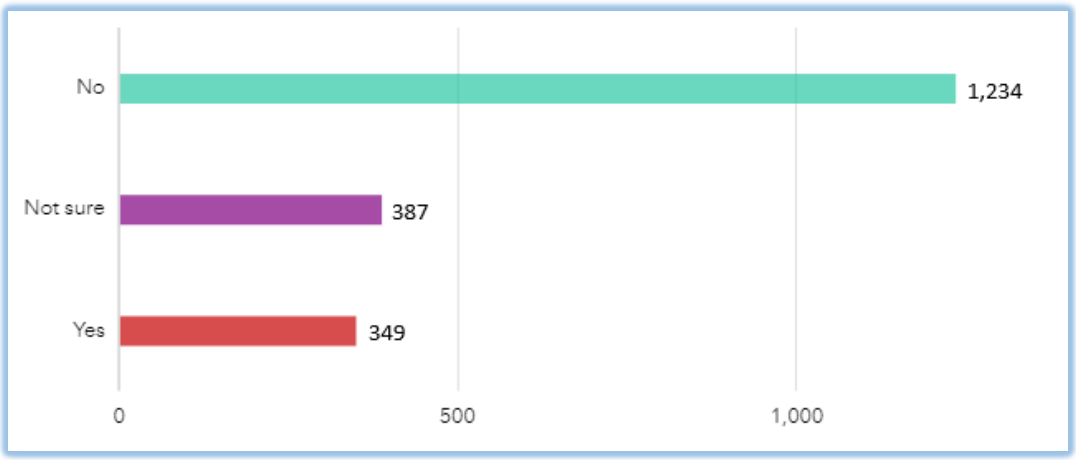
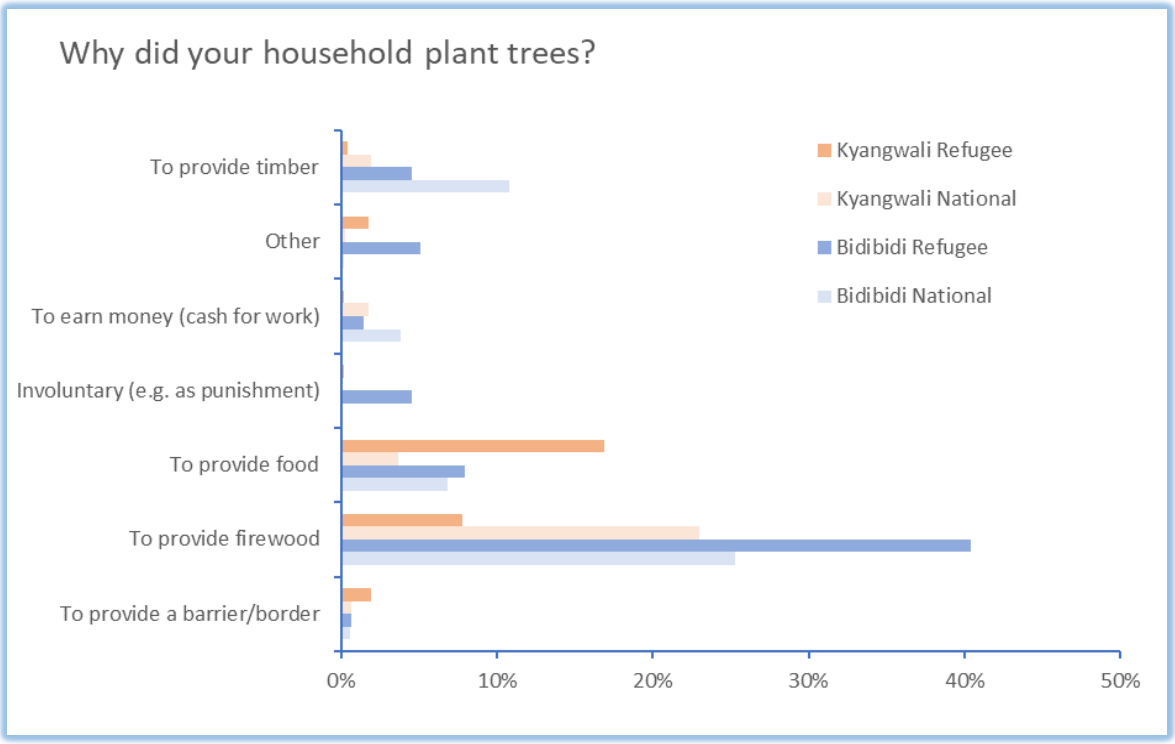


Figure 16. Household survey responses to the question 'Do you think you will have access to trees for firewood and timber in five years' time? (Select one)' shows most respondents in both sites are pessimistic about future access to trees.

Figure 17. Household survey responses to the question 'Why did your household plant trees? (Select all that apply)'.



5.2.4 Governance challenges

Policies and programmes geared toward environmental restoration in refugee settlements face multiple challenges at national and local scales. Despite government efforts at environmental mainstreaming there is criticism amongst partners that policy implementation has been lacking. 'The environmental policies are there, but implementing those policies is really challenging', noted an LWF employee. Others claimed that environmental objectives are 'completely left out' of refugee programmes. Often this is a result of funding shortfalls, lack of institutional capacity, large refugee and host populations and the long-term nature of environmental objectives (NEMA 2017; World Bank 2019a; OPM and UNHCR 2020).

As explained by a representative from the Ministry of Water and Environment when asked to outline the government's plan for its natural environment in refugee settlements:

'It is a full restoration, but the backlog is funding. Because if you look at these comprehensive plans for three years and we say the plan is a rolling plan, so one year down the road what have we done, 25%. Can we finish the next one in the remaining two years, no. So we need additional time to restore this environment.'

Environmental goals can also be side-lined in emergency refugee contexts, when providing immediate relief is required. An OPM representative explained that 'environmental restoration comes in at some other point when these refugees have settled.' Sectoral collaboration on isEnvironmental goals can also be side-lined in emergency refugee contexts, when providing immediate relief is required. An OPM representative explained that 'environmental restoration comes in at some other point when these refugees have settled.' It is worth noting that the latest Refugee Response Plan demotes 'environment and energy' as a priority outcome, strengthening its focus on protection and livelihoods in the wake of COVID challenges (OPM and UNHCR 2020).

Sectoral collaboration on issues of environmental protection has also been lacking. Issues such as environmental degradation and gender-based violence are interlinked (section 5.1), requiring close partnership between government sectors to address these socio-environmental challenges. As a respondent from ICRAF made clear, these issues need to be addressed 'in a

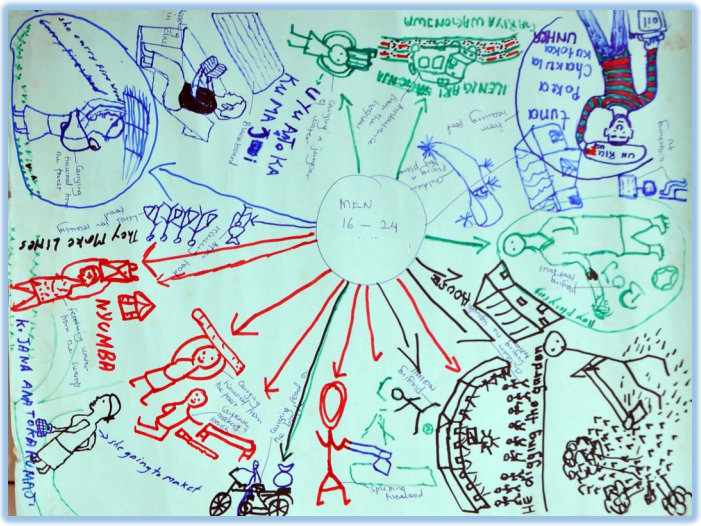
A path taken by women when fetching water, Kyangwali.

systems approach' rather than in silos. NDP III points to a lack of integrated thought between sectors towards delivering on government policies and pledges, and has introduced a programme-based approach to budget allocation and development planning in order to avoid sectoral duplication and conflict (NPA 2020). According to government respondents these challenges are exacerbated by OPM 'deciding to take on a role that it is not mandated to do', side-lining NEMA on issues of environmental concern in refugee settlements including wetland cultivation and development. As one respondent from LWF commented, 'NEMA is not very involved in refugee operations [and] we do not have a clear framework on how we can protect the environment amidst the refugee influx.'

At NGO and agency level there is also a lack of coordination with partners 'doing their own things', as one MWE employee put it. This has led to the duplication of environment and livelihoods programming, leading some stakeholders including Yumbe's Rural District Commissioner to call for a streamlining of NGOs involved to improve efficiency and environmental outcomes:

'We need a specific NGO, not just an NGO having a number of programs then also having the environment aspect in one of their programs. […] a specific organisation that can handle issues of environment […] so that funds and programs can be channelled through this kind of organisation rather than 20 or 30 NGOs doing the same thing. At times the sustainability is not there.'

Governance challenges at the local level also hinder efforts to foster sustainable livelihoods and environmental protection. Local corruption may facilitate deforestation in both settlements, and there are claims that government forest rangers accept bribes from community members to enter Bugoma Forest. As a young man from the host community in Kyangwali explained, 'if a ranger finds me there, I can give him like 5000 shillings [around £1 GBP] then he leaves me to go' [Patrick]. In Bidibidi village leaders said to be 'after some money' [Deen, host] are charged with accepting payments for access to trees. Poverty and power inequalities underly these problems, some being able to afford to pay for access to trees whilst others have the power to permit or refuse access.



Participatory map created by a group of young men in Kyangwali.

Yet this lack of local regulation does not stem solely from corruption or economic motives, but also a lack of authority and power amongst local actors. In Bidibidi host communities spoke of 'trees that were not accepted to be cut down' [Yahaya] and 'places we were not allowed to touch or cut trees' in the past [Hassan]. Yet the data indicates that these rules are no longer enforced. In Bidibidi respondents noted that authority over trees rests with district officials rather than local leaders, and in Kyangwali respondents claimed OPM controlled forest access and that 'community leaders do not have the powers' to prevent or permit forest access [Gabby, host]. Lacking local authority to curb unsustainable tree felling in Bugoma Forest, some host community members in Kyangwali are calling for tighter regulation and restrictions, including increased ranger presence and more severe punishment for illegal forest entry. This is surprising given the claims of physical abuse levelled at forest rangers and is an approach that would likely exacerbate livelihood difficulties for both refugees and hosts in the short-term.

At both sites informal and insecure rights over customary land and natural resources contribute to environmental degradation and interrelated community conflicts. Recognised under the Land Act of 1998, customary land is the most widespread tenure type in Uganda and represents land ownership in host communities in both settlements. Customary land rights are rarely institutionalised or written down but are regulated by customary principles and adjudicated by clan chiefs (Banana et al. 2014; Boswell 2018). Particularly in Bidibidi, the arrival of large numbers of

refugees has highlighted the fragility of traditional governance structures and led to land and boundary disputes, discussed above. In Kyangwali host communities remain fearful of land appropriation after families were evicted from ancestral lands to settle refugees in 2013 (Parliament of Uganda 2021), and there are also claims that customary land has been sold by local 'mayors' in collaboration with OPM and Refugee Welfare Councils (UNHCR 2018b). Group discussions brought these issues to light, a male respondent stating:

'OPM and government are evicting us from the land, claiming that the land where we are settled belongs to the refugee settlement. This has greatly disturbed us to the point that we even fear to do any developments for fear of being evicted.' [Waren, host]

Government attempts to validate these rights through certificates of customary ownership (CCOs) have made slow progress, whilst NGOs have struggled to draft MoUs formalising these land access and sharing arrangements between refugees and host communities in Bidibidi.

At the same time, land tenure and resource access insecurity contributes to environmental degradation and hinders conservation programmes. Most forest loss in Uganda takes place on private and customary land where short-term reward through (commercial) logging and charcoal production, for example, outweigh community incentives to conserve natural resources (World Bank 2019a; Owor and Dieterle 2020). As a means of motivating local communities to protect trees, the National Forestry Policy (NFP) of 2001 and National Forestry and Tree Planting Act (NFTPA) of 2003 contain mechanisms for the registration of Community Forests on customary land. Community groups registered as Communal Land Associations are granted *de jure* rights by the state to manage and benefit from gazetted community forests under the supervision of district forest officers (Mawa et al. 2021). Similarly, Ugandan law and policy contains provisions for Collaborative Forest Management (CFM) arrangements between NFA and communities neighbouring Central Forest Reserves. After forming and registering community-based organisations, these local groups

A woman ties up a bundle of collected firewood, Bidibidi.

share rights, responsibilities and benefits alongside NFA in specified state forests. This might include local communities undertaking forest patrols and monitoring in return for benefits such as access to forest resources and land for tree planting (Kazoora et al. 2020). Despite evidence that Community Forests and Collaborative Forest Management have improved conservation and livelihood outcomes in Uganda (Mawa et al. 2020, 2021), a lack of funding and institutional capacity has meant that these participatory approaches are absent from many areas of the country, including Bugoma CFR (Kazoora et al. 2020).

5.3 Summary

In both settlements environmental change has reduced community access to land and natural resources essential to livelihood sustainability. The situation has exacerbated refugee precarity, particularly in Bidibidi where refugees are subject to informal and exploitative land use arrangements with hosts. In Kyangwali refugees are less dependent on local legitimisation for natural resource access, yet both communities – and particularly women – face safety risks when entering Bugoma Forest. Policy and programmes geared toward environmental protection and generating sustainable livelihoods face multi-scalar governance challenges that will need to be addressed if those objectives are to be achieved.

Grass being used in roof construction, Bidibidi.

6. CONCLUSIONS

This report draws on extensive triangulated data from multiple sources to examine the complex connections between environmental change and sustainable livelihoods in densely populated rural locations with large refugee settlements. Remotely sensed data clearly shows landscape fragmentation and tree cover reduction for both case study sites over the recent period of intense refugee influx. In Kyangwali the extent of tree cover in the area of Bugoma Forest near to the settlement has decreased by 7.5% between 2015 and 2021, with increased forest fragmentation and a reduction in the mean size of remaining patches by 50%. In Bidibidi residential and bare ground land cover classes have increased, resulting in land cover fragmentation and a 50% reduction in tree cover between 2015 and 2021 that has yet to regenerate. Large-scale survey and in-depth qualitative analysis reveal that these changes are partly driven by local population pressures and associated natural resource-based livelihoods, particularly household demand for fuelwood and timber. Yet the report analysis indicates that (inter)national political–economic factors also drive change, including the commercial production of timber and charcoal for urban markets that utilises the cheap labour of local people who have few alternative livelihood options.

The environmental changes occurring in these locations present major livelihood challenges for refugee and host communities lacking access to natural resources, although the dynamics of these human–environment interactions differ between settlements. In Kyangwali, refugees have been settled adjacent to Bugoma CFR, contrary to UNHCR's global planning guidelines and Uganda's conservation objectives (World Bank and FAO 2020). Refugee presence has instigated new government regulations governing forest access, and both communities suffer from protectionist policy in Bugoma Forest where rangers strictly monitor those attempting to collect timber and firewood. Unlike Kyangwali, refugees in Bidibidi are dependent on host community legitimisation and interaction for access to natural resources, which results in conflict arising between refugees settled on communal land and those already living there. Refugees are chased and sometimes beaten when attempting to collect firewood and are subject to unequal and exploitative relations of production when making charcoal in host community areas. At both sites individuals and households are impacted by these socio-environmental changes in different ways, women refugees in particular suffering hardships associated with collecting firewood under challenging conditions.

The report analysis highlights that efforts to combat environmental degradation in and around refugee settlements are hampered by a lack of sectoral collaboration and coordination on conservation and sustainable livelihoods at the national scale. At the local level, refugee arrivals and rapidly changing community dynamics have upset existing customary land and natural resource management arrangements. Particularly in Bidibidi, environmental degradation is linked to poorly defined land access and resource use rights, refugees being subject to informal and exploitative land use arrangements in host areas which exacerbate livelihood insecurity. These learnings from the research can be translated into outcomes through policy recommendations for improved environmental management and livelihood security, outlined below.

7. POLICY RECOMMENDATIONS

Policy-makers and practitioners recognise the critical links between environmental change and livelihood sustainability in refugee settings, and this report acknowledges important existing approaches to mainstream environmental objectives into refugee response strategies in Uganda. The research analysis also highlights political-economic and socio-environmental challenges that hinder environmental mainstreaming efforts. To assist stakeholders to address these problems and foster sustainable livelihoods for refugee and host communities, the following policy recommendations are put forward, accompanied by targeted action points for key organisations, with the primary coordinating organisation highlighted in blue.

1. Settlement and land-use planning

Refugee numbers are forecast to continue to increase; therefore long-term strategic planning of settlements, rather than remedial measures, will help avoid the types of environmental degradation in refugee hosting landscapes observed in this research. Recommendations:

- Recommendation 1.1. Government partners and development agencies work together to develop a plan guiding decisions on establishment of new settlements and location of new refugees. This should be based upon potential natural resource availability and requirements, and environmental impact assessments.

⇒ Action 1.1.1: OPM, MWE, MLHUD, MLG, NEMA and NFA, along with UNHCR, UNDP and FAO, should develop a national scale settlement planning tool to guide decisions on locating new refugees and settlements.

⇒ Action 1.1.2: MLHUD, NEMA, MLG, and NFA should demarcate areas that can host refugees and IDPs e.g. per district, together with their corresponding estimate of natural resource provision.

⇒ Action 1.1.3: OPM, NEMA, MLHUD, MLG, MWE and NFA to undertake Environmental and Social Impact Assessments (ESIAs) at potential settlement locations prior to their inclusion in the national scale settlement planning tool.

- Recommendation 1.2. Strategic settlement and land-use plans should ensure provision for at least one acre of woodlot per 100 households to satisfy household demand for firewood and timber, as stipulated in the MWE sector response plan.

⇒ Action 1.2.1: OPM, MLG, NEMA, UNHCR, FAO and UNDP to undertake ESIAs at existing refugee settlements and ensure resulting Environment Action Plans (EAPs) and woodlot provisions are implemented.

2. Cross-sectoral collaboration and coordination on environment and livelihoods

Challenges in partner coordination and collaboration leads to a lack of environmental protection in refugee hosting landscapes as well as duplication of activity and resource wastage. Recommendations:

- Recommendation 2.1. Closer partnership and collaboration between government sectors and agencies is required in order to address interlinked socio-environmental challenges.

⇒ Action 2.1.1: Cabinet Policy Committee on the Environment, its working groups and sub-committees, should monitor collaboration between government sectors on issues of environmental management in refugee settlements.

List of Abbreviations

CF: Community Forests
CFM: Collaborative Forest Management
CFR: Central Forest Reserve
ESIAs: Environmental and Social Impact Assessments
EAPs: Environment Action Plans
FAO: Food and Agriculture Organization (United Nations)
IPs: Implementing partners
MGLSD: Ministry of Gender, Labour and Social Development
MLG: Ministry of Local Government
MLHUD: Ministry of Lands, Housing and Urban Development
MWE: Ministry of Water and Environment
NEMA: National Environment Management Authority
NFA: National Forestry Authority
OPM: Office of the Prime Minister
UNDP: United Nations Development Programme
UNHCR: United Nations High Commissioner for Refugees

- Recommendation 2.2. Important environmental stakeholders, coordinated through NEMA, should be included from the outset in policy processes related to environmental management in refugee settlements.

⇒ Action 2.2.1: Natural Resources, Environment, Climate Change, Land and Water Management Programme Working Group to align its objectives and operations with national government sector policies and guidelines; membership should include representatives of host and refugee communities.

- Recommendation 2.3. Improved coordination amongst implementing partners (IPs) to avoid programme duplication and resource wastage.

⇒ Action 2.3.1: Department of Refugees and District governments should continue to work closely to avoid duplication, strengthen coordination and ensure optimal allocation of resources across all IPs operating in settlements.

⇒ Action 2.3.2: All partners target and direct funding towards long-term projects better suited to long-term environmental goals, rather than multiple short-term projects.

3. Environmental and Livelihood Interventions

The research indicates an almost total reliance of refugees and host communities on natural resource-based livelihoods, driven in part by lack of training and opportunities, as well as poor uptake of alternative fuel sources and technologies. Recommendations:

Recommendation 3.1. Interventions should be directed towards supporting livelihood diversification in host and refugee communities through vocational skills, enterprise selection and training aligned to NDP III and based on market assessment by Ministry of Gender, Labour & Social Development (MGLSD).

Village settlement in Bidibidi.

A home in Kyangwali.

⇒ Action 3.1.1: OPM and development partners target interventions toward harnessing existing host and refugee knowledge and skills that reduce dependency on natural resource-based livelihoods.

- Recommendation 3.2. Environmental sensitisation and education programmes are required to reverse current trends, and local/national government awareness programmes about environmental stewardship and degradation should be implemented.

⇒ Action 3.2.1: OPM and UNHCR to implement distribution of energy saving technologies and training as part of the essential items package given to all new refugees at reception.

⇒ Action 3.2.2: UNHCR ensure refugees are sensitised on, and included in, processes of 'tree marking' in order to reduce conflict with host communities.

- Recommendation 3.3. Interventions should be site- and context-specific, and variable within a particular settlement dependant on differing environment-livelihood interactions between zones/villages.

⇒ Action 3.3.1: OPM and NEMA should target environmental interventions including community sensitisation around the ecological impact of bush burning in locations such as Bidibidi.

- Recommendation 3.4. Broader political-economic drivers of degradation need to be addressed, including urban and international charcoal demand, and improvements made in provision and sensitisation around affordable alternative fuel technologies.

⇒ Action 3.4.1: District officers and government should reduce demand for charcoal in urban areas (particularly those neighbouring refugee hosting areas) through sensitisation on, and incentives for the use of alternative fuel technologies.

⇒ Action 3.4.2: MWE, UPF, Uganda Revenue Authority and cross-border agencies to target the informal border trade of charcoal.

⇒ Action 3.4.3: OPM and Ugandan Parliament should consider formulating legislation to ban the export of charcoal.

⇒ Action 3.4.4: NFA to explore sustainable methods of charcoal production for local markets, through the use of fast-growing woodlots and cooperative production as an alternative source of livelihoods.

4. Land and natural resource use rights

Uncertainty over land rights and ownership lead to unsustainable landscape management practices and community tensions. Recommendations:

- Recommendation 4.1. Stakeholders should work with host and refugee communities to formalise land and natural resource access and sharing arrangements and address locally-specific issues such as bush burning and crop damage by livestock.

⇒ Action 4.1.1: OPM, MWE, MLHUD and NFA should work alongside IPs to help host and refugee communities draft agreements clarifying land and natural resource access rights for refugees in host community areas.

Sacks of charcoal, Bidibidi.

Women walking with collected sticks, Bidibidi.

5. Community participation in forest and natural resource management

Successful ecosystem management requires involving host and refugee communities in natural resource management in collaboration with OPM and IPs. Increased community ownership and co-management of forests can ease the burden on government enforcement staff struggling to protect forests and wetlands with limited resources. Recommendations:

- Recommendation 5.1. In accordance with Ugandan forest policy and legislation, NFA and forest user groups should work toward CFM arrangements to share forest rights, responsibilities and benefits, and support the sustainable management of forest resources.

⇒ Action 5.1.1: NFA and development partners should encourage formation of forest user groups among refugee communities in Kyangwali and enter into MoUs for participation in CFM in Bugoma CFR alongside existing agreements with host communities.

- Recommendation 5.2. In accordance with Ugandan forest policy and legislation, work toward the declaration of CFs on customary land, creating designated community-level institutions responsible for the sustainable use and management of forest resources.

⇒ Action 5.2.1: NFA District forest officers should assist host communities and refugees to form and register communal land associations, and to gazette CFs on customary land.

Illegal logging at the fringes of Bugoma Forest Reserve, Kyangwali.

⇒ Action 5.2.2: NFA should seek funds from and collaborate with development partners such as UNHCR and UNDP to allocate sufficient financial and human resources to support actions 5.2.3, 5.2.4 and 5.2.5.

⇒ Action 5.2.3: NFA and development partners should promote CFM and CF programmes.

⇒ Action 5.2.4: NFA and development partners should introduce gender-sensitive training for government forest rangers and community forest officers to ensure human rights are respected.

⇒ Action 5.2.5: NFA and development partners should harness local knowledge through conservation activities, including environmental education and monitoring. For example, training refugees and host community members as community forest officers.

6. Sustainable resources and landscape restoration

Demand for fuelwood and timber are the leading causes of forest degradation at both sites, therefore widespread restoration of landscapes is unfeasible due to pressure on natural resources. Conservation of biodiversity and ecosystems is required yet communities must have access to sustainable sources of these products. Recommendations:

- Recommendation 6.1. Woodlots should be consolidated and planted adjacent to Bugoma CFR and on customary land in both settlements to provide household firewood and timber, incorporating agroforestry approaches allowing refugees to grow short rotation crops amongst trees.

⇒ Action 6.1.1: NFA and district forest officers to assist communities with the planting and consolidation of woodlots through CFM arrangements in and adjacent to Bugoma CFR and gazetting of CFs on customary land in both settlements.

⇒ Action 6.1.2: NFA and development partners should create ecological awareness to plant and promote use of indigenous species crucial to ecosystem health rather than exotic species for household use.

⇒ Action 6.1.3: NFA and IPs to implement effective aftercare, monitoring and protection for trees planted, with significant community involvement and ownership through collaborative management approaches.

⇒ Action 6.1.4: NFA should promote restoration of recent forest loss around Bidibidi.

- Recommendation 6.2. Research commissioned into best practice for forest and landscape restoration in refugee hosting landscapes to maximise use of limited financial resources and incorporates refugee and host community views to ensure successful outcomes.

⇒ Action 6.2.1: OPM and Cabinet Policy Committee on the Environment should commission continued research to ensure evidence-based best practice for landscape restoration, taking into account scale of degradation, land ownership issues, potential community benefits, biodiversity, and natural resources.

Pigs and crops, Kyangwali.

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Recommended citation:

University of Dundee, UK/Makerere University, Uganda. (2021). Displaced Communities, Environmental Change and Sustainable Livelihoods in Uganda, Final Report. Dundee: University of Dundee. DOI: 10.20933/100001221.